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This collection of seven significant articles on higher thought processes stresses the important relationship of these processes to the teaching of language skills. The articles are: (1) "Language and the Habit of Credulity" by Russell G. Stauffer. (2) "Research on the Processes of Thinking with Some Applications to Reading" by David H. Russell, (3) "Form Consciousness, an Important Variable in Teaching Language, Literature, and Composition" by James R. Squire, (4) "The Teaching of Thinking" by Hilda Taba, (5) "Concept Formation in Children" by Harriett Amster, (6) "The Quality of Qualification" by Murray S. Miron, and (7) "Expressive Thought by Gifted Children in the Classroom" by James J. Gallagher. (DL)

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Prepared by a Committee of the National Conference on Research in English
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Language and the Higher Thought Processes

A Research Bulletin
Prepared by a Committee
of the

National Conference on Research in English

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Contents

Why This Bulletin? v

Language and the Habit of Credulity 1
Russell G. Stauffer

Research on the Processes of Thinking with Some Applications to Reading 9
David H. Russell

Form Consciousness, an Important Variable in Teaching Language, Literature, and Composition 19
James R. Squire

The Teaching of Thinking 31
Hilda Taba

Concept Formation in Children 40
Harriett Amster

The Quality of Qualification 50
Murray S. Miron

Expressive Thought by Gifted Children in the Classroom 56
James J. Gallagher

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1965 President

JEANNE CHALL

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Why This Bulletin?

Ushered into the educational arena of our society in recent years have been a variety of proposals aimed at both quick and permanent changes. The currents of some of these movements have been as strong as their shoals have been treacherous. Some among us have been seriously intimidated; some have panicked; some have stood firm and, as professional peopeople, have sought a high level of competence.

Our nationwide concern that all be educated has caused us to realize more clearly than ever that, where human learning is concerned, there is no one best way of teaching or learning. We also see more clearly that how children will share our literary heritage depends to a considerable degree on where they are born, how they grow, how they see the *why* or *worth* of things, who loves them. Looking at the privileged and underprivileged among us has caused us to reexamine the meaning of literacy and to note that intellectual slums exist at all social levels.

Facing up to our intellectual slums is requiring a new look at how thinking man catalogs his universe and attempts to order things. The respect and forbearance of the thinking mind has taken on new dimensions. This has helped us in our reexamination of American education and what it dares to do. Frank G. Jennings puts it this way in his refreshing *This Is Reading*:

> First, it is based upon the clear democratic notion that all children, whatever their backgrounds, whatever their physical and intellectual limitations, be helped to become the very best kinds of persons. By *best* is meant that they achieve the skills and the knowledge that will help them to realize as much as possible of their grandest dreams. This concept of American Education is not one of leveling down all people to a kind of social least common denominator. It is the giving to everyone of the will and the desire to reach beyond his grasp.[1]

At another point Jennings says: "What we say learning is will determine how we teach. What we conceive learning to be will depend on what we think *mind* is. Thus if the mind is merely a collection of faculties, training is required. . . . But if mind is a function, as most contemporary psychologists would insist, then learning is a far more complex affair."[2] Because we think with language it is without a doubt the most momentous product of the human mind. It reflects man's ability to abstract and to symbolize, to deal with time and place and conditions, to make comparisons and to have preferences, and to socialize. Language is the prime tool of the scholar.

Requirements of a scholar are interest, enthusiasm, an appetite for ideas, and the intellectual courage and integrity necessary to understanding knowledge and the management of experience. How scholarship of this caliber is to be attained in a society that deliberately tries to teach skills or knowledge to others is not a secret. A clear and vigorous statement in this regard was prepared recently by the California Teachers Association's Commission on Educational Policy. After prolonged deliberations the Commission produced a document that defines the dimensions of excellence in education. There are six clusters of ideas in the document which are not to be viewed as constituting an orderly progression or any sort of continuum but rather to be viewed as being mutually supportive. The six dimensions are:

Capacity for inquiry
Problem-solving competence
Communication and computation skills
Familiarity with organized disciplines
Cultivated enjoyments
Democratic commitment[3]

The first three dimensions have the flavor of processes, and the other three bear the quality of outcomes. The Commission deliberately placed at the head of the list the dimensions concerned with processes because pedagogical instruction should call forth these processes. The subject matter disciplines should feed these processes in the process of the student's becoming familiar with knowledge. The curriculum should engender productive thinking. Instructional situations should be created in such a way that students can be taught to arrive at decisions by honest and open deliberation of many choices rather than by indoctrination of a single choice.

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[1] Frank G. Jennings, *This Is Reading* (New York: Bureau of Publications, Teachers College, Columbia University, 1965), p. 113.

[2] *Ibid.*, p. 42.

[3] California Teachers Association, Commission on Educational Policy, *Dimensions of Excellence in Education* (1705 Murchison Drive, Burlingame, California: CTA Publications Supply, 1965, 25 cents).

While each dimension plays a significant role, it is not by accident that the skills of communication and computation through language, numbers, and other symbols have to be regarded as the "fundamentals." Just as the use of language is essential to communication, so, too, is it essential to inquiry itself. Productive thinking is dependent upon clear and accurate communication.

Reports on a conference concerned with the basic cognitive processes in children suggested that cognitive functioning requires the development and use of verbal mediators as well as the selection of dimensions for stimulus categorization.[4] Also suggested is the idea that the process be active, questioning, testing, and inventing; and that it result in information-producing behavior. The "close hard look" and the "what is it?" response apparently play a major role in even the most primitive form of cognitive functioning. Succeeding stages of development apparently involve the deliberate use of verbal labels and mediators and the wise selection of dimensions and strategies so that purposeful behavior and active information processing may result.

All this leads to the conclusion that the teacher is even more intimately involved in the learning process than may sometimes be thought. The teacher must arrange the learning environment so that students are provoked to search for and define problems, or to ask questions. Furthermore, it is the teacher's responsibility to see to it that the problems defined are significant; that answers are accepted as provisional, and lead to questions of further importance and to generalizations for next steps. "Students can be instructed in apprehending cause and effect, the relationships of situational factors, the benefit of organization and system, the dependence upon accuracy, the need for examining alternatives, and the requirement for evaluation of decisions."[5]

Language emerges from all this as the essential medium in formal education. A meaningful use of the skills of reading, writing, speaking, and listening is required in our schools today more than ever. As teachers become skilled in bringing out of their instruction high competence in these skills, excellence will result. It is toward this end that this publication has been prepared.

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[4] *Basic Cognitive Processes in Children*, eds. John C. Wright and Jerome Kagan (Monograph of the Society for Research in Child Development, Serial No. 86, Vol. 28, No. 2.; Chicago: The University of Chicago Press, 1963).

[5] California Teachers Association, Commission on Educational Policy, *op. cit.*, p. 10.

RUSSELL G. STAUFFER

Language and the Habit of Credulity

It is commonly accepted that language is the instrument that, better than any other, enables persons both to develop and to participate in their culture. Granted that this is true, it follows that language is a symbol-system of vital importance to each individual and to his society.

When an infant discovers that a cry can produce certain desired results, he has made a start on the long road toward acquiring a language and being a part of a collective communication system. This is especially so when the child begins to realize that he can participate in the language community as both a producer and receiver of symbols (4, p. 24). The knowledge that this presages the difference between man and animal is indeed vivifying. As a producer and receiver the child differs sharply from the Pavlovian dog who is also responding to a symbol (the bell) with a response (salivating) when the chain of events is initiated by man. And this difference is strikingly apparent when one notes that there can be no reciprocal relation between the dog and the man.

This ability to learn and use language is different from the power among insects to perform feats of amazing skill. A Sphex wasp, for instance, has the ability to perform a delicate and exacting nerve operation on an Ephippiger grasshopper. The operation paralyzes the legs, leaving the grasshopper helpless and a ready supply of living food for the wasps to be hatched.

"Once the paralysis is accomplished the wasp drags the victim to its nest by an antenna. When, however, the antenna is cut off, the wasp is baffled, and can't conceive of any other way to move the grasshopper. It has been concluded then that while insects possessed highly specialized instinctive skills, which they didn't need to learn by teaching or example, they completely lacked the ability to reason" (16, p. 119).

Unlike the Sphex wasp but like the Pavlovian dog, the child makes associations between a symbol and an experience. But unlike the Pavlovian dog the language symbols are not artificial products of an experimental situation. Most of the first symbols a child learns to isolate and use are acquired in a first-hand experience situation. Usually these learnings are related to concrete things which are perceived directly through the senses—milk, mother, doll. Whether children first learn to use words at age one or at age two and a half the learning demands are the same. Each child must associate, select, use, and remember.

Sooner or later children discover that not all symbols refer to concepts on the object level. While it is thought that between the age of eighteen to twenty-four months children live predominantly in the present, some ability to project into the future is developing. Ames reports that "Words indicating the present come in first,

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then words indicating the future, and finally those indicating the past. Thus 'today' (24 months) precedes 'tomorrow' (30 months) which in turn precedes 'yesterday' (36 months)" (3, p. 122).

It is at about this point in the child's long, slow progress toward language maturity that he attains an awareness, even though vaguely, of two basic conditions. First, he begins to realize that all the things in his world have names and that folks about him know these names. The period is sometimes affectionately labeled as the "What's this?" age. Second, little by little he learns to deal with words that represent relative and indefinite ideas—the *little* dog, the *little* boy, the *little* car, the *little* house. Puzzling as it may be, he gradually learns to use *little* discriminately and in so doing takes a big step on the road toward understanding multiple meanings and figurative language.

As the child learns to deal with words like *little* he learns to deal with incongruities of meaning and use. At first he uses the word appropriately in different contexts under different communication demands almost as if by intuition. Somehow he learns to recognize a common element in the different situations in which the concept of *little* fits. Not being articulate, though, about the many specifics that enter into each use of *little* (*little* toy-*little* storm) he operates in part on knowledge and in large part on extrasensory intuition. Here his intuition rests in the degree of constancy associated with the variables of *little*.

Even so, when dealing with concepts of *little*, referents usually are a part of the sensory world and can be reexamined. Thus while there is present a certain amount of blindness and a certain demand to accept by intuition or faith, the degree and amount is not as great as when the child deals with a concept like *tomorrow* because *tomorrow* never comes. Yet as Ames and others (12) point out, children learn to deal with the concept *tomorrow* at an early age. Somehow they must recognize some of the attributes of the concept *tomorrow*. Certainly, though, there may be judged to be present a greater degree of blindness and a greater demand on intuition than when dealing with concepts such as *little*.

It seems then that the intuition demands required when dealing with concepts like *shoes, little*, and *tomorrow* can provide the readiness for dealing with concepts like *democracy, peace*, and *eternity*. Could it be said therefore that the beginning of faith and of credulity originates in the "word" or in a symbol?

Today, tomorrow, then yesterday. One might well auger here the hope that springs eternal and use this early learning pattern as a revelation of man's vision—to look ahead from today and with increased maturity to have that look ahead be tempered wisely by the past. As Ames (3) goes on to say, the age of three to five brings with it much greater projection into the future, until by age eight even extremes of time span can be handled adequately.

Gradually, though, the veil of an individual's and his culture's emotional, intellectual, and spiritual world creates gossamers that may lead to stereotypes, prejudices, and sentiments as well as to convictions and beliefs. Now he learns the special idioms of the teens, the slogans and stock phrases of the propagandist and the publicity agents, and the stories and puns of the adults. Shifts of meaning are subtle and varied and their acuteness may often go unrecognized. Fortunately, though, over all is the innateness of laughter and the range of things laughed at (11, p. 86). And as Stephen Leacock believes "humor in its highest meaning and furtherest reach... finds its basis in the incongruity of life itself... and becomes the contemplation and interpretation of our life" (8, p. 15). Then as a person deals with the verbal conventions of his time, he discovers that humor can be the wedge that amplifies the need to adjust concepts to the ever-shifting realities of experience.

Children love fun. They seem to be natural pranksters unless, as one author puts it, it's been spanked out of them. The carefree, spontaneous, enthusiastic laughter of children uninhibited by the sober conventions of adult society has through the ages been a favorite *genre* of the poets.

From games and jokes and pranks to fun with words seems an easy step and usually occurs early in the word-life of children. Here their imaginations are undiminished. From nursery rhymes and ditties to *Winnie the Pooh* to *Paul Bunyan* is easily accomplished as they disarmingly toy with the protective masks of phantasy and unreality. They catch shifts of meaning that occur in children's puns, in simple name calling like "you're a grandmother," or "you're a hamburger with onions." All this requires a sense of intuition and of credulity. Humor seems to represent the early development of a language thermostat that permits them to keep their language habits on a controlled level and thus avoid the emotional breakdowns that stem so frequently from communication misunderstandings. A good sense of humor has for a long time been referred to as an emotional stabilizing asset.

So as children mature and achieve a clearer grasp of the common and uncommon concepts in their world of culture, the sophistication will surely remove the innocence from their eyes. And it is our duty to see to it that this change not be marred by the cold brittleness of bitter disillusionment. Rather we must see to it that the maturing be activated by the subtle vibrations resulting from a love for the creative and the substantial resources of an outlook on life that is built on faith.

And so the individual learns that "the symbols of language are slippery things. They do not stay put: they carry multiple meanings, which shift from time to time and differ from place to place; their ostensible references overlaid with meanings of a non-rational character. It (language)* is the result of man's collective quest for expression, and it therefore reflects the cultural value, the changing attitudes and intentions and preoccupations by which man lives" (4, p. 17).

And so, too, man learns to accept meanings of things not experienced or if experienced not examined, or if examined not generalized. He learns to project on language a credulity that ranges from the naive to the sophisticated. First, he accepts names without question. For a while he tends to apply them indiscriminately on a class basis calling all children "boy" or all animals "bow-wow." Even as an adult he tends to accept labels such as *salt*, *grain*, and *love* without a check on their derivation and history or the reasons why their many uses developed and how they tend to be related. He learns to associate many meanings with *tomorrow* without perhaps ever being quite ready to deal with, "Tomorrow and tomorrow and tomorrow, comes ever and anon after today." He thinks of certain words as representing definite concepts and uses them as if they did until one day perchance he is asked to elaborate on the meaning of "How far is a mile?" Then he discovers that saying 5,280 feet or 1,760 yards adds only limited clarity. It says nothing about the kind of mile, *i.e.*, a mile high, a mile deep, a mile under water, a mile wide canyon; the time of a mile, *i.e.*, a mile a minute, a four minute mile, a two week mile; or reactions to a mile, how tired is a runner after a mile, a mountain climber after ascending a mile, a golf player after playing six holes, and so on. He now sees this "definite" term *mile* being overlaid with various credulities and multiple ramifications. The many faceted world of connotations and the many faces of use make a difference.

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*Author's insert.

Now he accepts with a new kind of credulity the fact that our sun is 93,000,000 miles away in outer space and that other suns are even farther away. Light years take on an almost incredulous dimension as the old stereotype for *mile* is stretched seemingly beyond the demands made by an ageless generic.

As a result other stereotypes may come under surveillance: *mother, cowboy, astronaut, spartan.* Biases need to be juggled again: rich and poor, master and slave, old and new, near and far.

Throughout this multiplicand of change bounded by finite and infinite limits, humor can represent the impedance ratio between the polysemantic function of language and rudimentary single equivalence. It is through humor that he grows alert to the multiplicity of intents and implications latent in a single word or idea or concept, even though at times in their placing and stress they are contradictory. Such extravagance of meaning allows for full use of overtones and undertones of connotations and denotations, subtleties and acuities, synonyms and analogies.

And so, as man serves his apprenticeship to communication, his language and his thinking may be packed with fabulous credulities, beneath which may be, as Hook says of the peasant, a kind of vulgar empiricism (6). Needed is much training in the critical examination of language; in family circles, in classroom discussions, in friendship groups, and in private meditation.

Finally, as the child learns to deal with ideas through written language, he is introduced to more remote persons, places, and times. Now he should be led to discover anew that meaning depends upon the total incidences of a concept in his experiences and upon the context in which it is being used by the author.

The use of the simple verb *to brush* cannot be understood even if a dictionary is consulted unless the reader can examine the situation in which the word is used and examine his own experiences. "To brush a picture," means one thing and "to brush up in arithmetic," means quite another. Or, if a sentence read, "The settlers had a brush with the Indians," it might be necessary to do as one third-grade boy did: say that he didn't understand what *brush* meant here. With teacher help the boy did understand how he could brush against someone on the sidewalk and have a brief contact, perhaps almost a skirmish; and so he discovered that his experiences, when restructured, did provide some meaning for this different use of *brush*. Certainly his meaning was not as precise and vivid as that of his father who had a *brush* with the enemy on Okinawa. Even so, father and son would need a certain amount of credulity when reading about the American settlers and their *brush* with the Indians. Furthermore, for either the father or the son the "experience" of a "brush with the Indians" could be completely verbal. In other words, it could be that both father and son might have adequate understanding without ever actually having had a *brush* with anyone.

Then, too, it may be that the author never had a brush with the Indians. This fact together with the fact that the experiences of all three were different—father, son, author—makes perfect communication impossible. The necessity for interpretation always creates the need for credulity to some degree. So an intelligent and integrated person with a minimum of credulities might be described as "... one who is capable of sorting out his experiences, making pertinent distinctions among them, and seeing them in relation to his system of values. He is capable of making comparisons between two sets of data, two experiences, two generalized ideas, all without confusion between them. He cannot do any of these things at all unless he can attach verbal symbols to them for purposes of labelling, keep those symbols distinct, and manipulate them without confusion" (4, p. 4).

A Second Apprenticeship

The first language apprenticeship a person serves is to the spoken word. Not only do most people first learn to formulate concepts and communicate ideas as receivers and producers of oral language, but they do so with increasing frequency and effectiveness as they grow and mature. Many use oral language with a considerable degree of adequacy without knowing their language's grammar, either its morphology or syntax. The skill results from actual experience with audience reaction. The drama of face to face communication spotlights the need for studying audience effects, for restating, and for clarifying abstract ideas. It is this experience of speaker-listener interrelationships which emphasizes the differences between oral and written communication (5).

In written communication, a face to face interaction between the author and the reader is an uncommon experience. The demands on the writer are greater than those made on the speaker. The writer must carefully choose his words. His first obligation is to write with precision. Certainly he must keep his audience in mind but he need not avoid using words that may tax his reader's vocabulary. Certainly he must know the demands of the language of prose and the language of poetry.

The reader, in turn, must understand that writing usually involves a more disciplined and compact form of communication. He must, in the final analysis, know how to find out the "whole" truth by carefully examining and weighing the ideas recorded so as to grasp their full meaning and to identify the hidden implications and the motives of the author. To do all this he must learn to read and do productive thinking.

To train a reader so that he can deal with different interpretations and examine the assumptions and implications of each is to help him avert habits of credulity. Such training should be started when the child first learns to read. Then as he increases in ability to recognize printed words as conveyors of ideas he will become more effective in understanding what is being said and why it is said (13).

Children just learning to read can be taught to sort out their experiences, make pertinent distinctions among them, compare them with those of the author, generalize concerning the ideas presented, and do so in relation to their system of values. As they mature emotionally, intellectually, and spiritually they can be taught how man's collective quest for wisdom is an ongoing process that reflects changing attitudes and intentions and preoccupations. They can also learn how to see things as they are, without illusion or emotional bias, and how to make choices or decisions that are sane, prudent, fair, and reasonable.

Such training is best initiated in a group situation in which all the children participating are required to deal with the same material. Under these conditions each member of the group can act as an auditor for each other member and require a searching examination of events to determine the facts and to test their quality, validity, truth, and accuracy (14).

It becomes apparent immediately that

such learning to read is a demanding task. It requires a command of thinking skills as well as reading skills. Obviously, too, reading of this high caliber needs to be taught. And the training should be started, as it could be, at the primary level, by using material that can be thoroughly intelligible to the reader or lies within his experience grasp. Story materials, if well structured, do lend themselves to such use because, as Adler (1) indicates, in general the ground plan for reading story material resembles the division of rules for reading scientific or expository works.

Gradually, though, as the reading materials provided through the intermediate and secondary schools cause the reader to go beyond his immediate experiences, the training must prepare the reader to deal with scientific or expository material as a thinking reader just as he learned to deal with the narrative variety (15). Then knowledge of grammar and logic becomes increasingly more valuable. This is especially so when a man reads something that at first he doesn't understand. And, as Horn (7) points out, this is usually the case in school.

A child learning to perform as a thinking reader must learn to do his own thinking. When he turns to a story he must learn to use the title to conjecture about the story. Certainly every reader does this to some degree but the trained reader does so deliberately and thoughtfully. Then as he reads the story he checks his speculations against the story to see whether or not he was right about what he thought would occur. As additional facts are given he may either confirm his assumptions and be more certain about the story outcome or he may reject his assumptions and declare new ones. And so on to the end.

As is evident when the reader is trained as described here, he is given much opportunity to deal in discoveries as he unravels the problems set up by the story plot. This approach to reading training might be described as a problem solving approach. By so doing, the opening remarks in the preface to G. Polya's *How to Solve It* seem to be appropriate:

> A great discovery solves a great problem but there is a grain of discovery in the solution of any problem. Your problem may be modest; but if it challenges your curiosity and brings into play your inventive faculties, and if you solve it by your own means, you may experience the tension and enjoy the triumph of discovery. Such experiences at a susceptible age may create a taste for mental work and leave their imprint on mind and character for a lifetime (9).

If there is one quality to which every able reader must be committed, it is the ability to find and test evidence. To accomplish this high objective, pupils must become skillful in identifying the relevant and the truthful in the light of thoughtfully declared objectives. It has been said by the sage that a good question is half an answer. Thus the predicting or declaring of assumptions provides a first step in the reading-thinking process. Examining evidence, noting relationships and discovering story trends provides a second step. If basic reading materials designed for use at the primary level consist of carefully structured story plots, the basic reading training can be directed as described and result in reading-thinking experiences at a susceptible age which may create a taste for mental work and leave their imprint on mind and character for a lifetime.

For purposes of clinical study and research, thinking may be classified into five main types: associative thinking, convergent thinking, problem solving, critical thinking, and creative thinking (11). To a considerable degree, though, all of these thinking types are closely interrelated and are used almost as one or may all be used by the able reader-thinker in dealing with a reading problem. Constantly as he reads and speculates and reads again the reader is doing associative type thinking; he's putting together the two and two of story events by making associations, and by recalling related personal experiences that fit the scene. As he progresses through the story the reader does convergent type thinking. From a broad divergent approach based on limited initial clues he narrows down the possibilities as he approaches the story end. Each purpose declared or each question asked or each purpose changed creates a demand for problem solving type thinking. And certainly as he proceeds the reader does critical reading. He weighs the evidence found against his experience and knowledge of acceptable standards and accepts or rejects, and this requires a critical attitude. Surely, too, as he proceeds he will have opportunities to be creative in his use of the information supplied. Or when a story is finished or expository material has been read he may be ready to declare two or three other acceptable and creative endings or next steps.

In all this the role of the teacher is of vital importance. Again as Polya says:

> 1. Helping the student. One of the most important tasks of the teacher is to help his students. This task is not quite easy; it demands time, practice, devotion and sound principles.
>
> The student should acquire as much experience of independent work as possible. But if he is left alone with his problem without any help or with insufficient help, he may make no progress at all. If the teacher helps too much, nothing is left to the student. The teacher should help, but not too much and not too little, so that the student shall have a reasonable share of the work (9, p. 1).

The teacher must avoid being the product of authoritarian indoctrination. She does this by saying frequently: What do you think will happen next? Why do you think so? Were you right in your thinking? Read the lines that prove you were right. She does not do the thinking for the children. She does not use the Pavlovian conditioned response approach. Rather she quickens the reading performance in an astute way so that essential concepts of time, space, people, humor, numbers, and morality are not overlooked.

The teacher can help pupils unobtrusively and naturally when she takes advantage of group thinking and challenging, especially in the problem solving atmosphere of a directed reading-thinking circumstance. She allows each pupil opportunity to learn to exercise self-control, to be systematic, to evolve ideas of his own to which he is committed by considered judgment, and to tolerate and respect different ideas of others. The amenities of social adjustment are required and acquired in a circumstance that is primarily concerned with children's mental development. It is in such an atmosphere that pupils can acquire the attitudes of honest thinking so that later in life they will always desire to be enlightened and informed rather than to be blind and unreasoning. The attitudes of a thinking reader affect not only what he reads and hears, what he accepts and rejects, but also the objectivity of his thinking.

Such training in reading will result in effective reading and thinking and help break the habits of credulity which unexamined concepts produce. It will help students clarify concepts on the "sense-data" (10) level and in turn those that cannot be subject to immediate sensation. As the pupils develop skill in using thinking techniques, they develop an appreciation for the value of reflective thought. Finding and using facts takes on functional significance as over and over again they look for relevant facts rather than trying to attain an idle, rote recital of "all" the facts. Gathering evidence, even story evidence, to support an assumption, requires an evaluation of the facts, organization of the facts, and the drawing of sound conclusions. In addition, pupils learn from repeated experience as they read through story after story and stop to reflect and conjecture at various points that assumptions based on insufficient evidence are tentative and that judgment must be suspended.

Conclusion

It has been stated that reading can be an obstacle to thinking and help extend the habit of language credulity initiated through the spoken word. Or, it can be a means of developing habits of clear thinking. Half-truths, superstitions, falsehoods, and prejudices can be detected and dealt with. It remains for the reader as well as the listener to be alert, seek out valid inferences, follow a careful chain of reasoning from fact to fact, and attempt to draw sound conclusions by testing his hypotheses. When this is done the practiced reader will, as Altick says, find "... abiding evidence that he is not so easily deceived as his neighbor" (2, p. 112).

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DAVID H. RUSSELL

Research on the Processes of Thinking with Some Applications to Reading

Research on the so-called "higher mental processes" has been a dubious, even precarious enterprise in this country for much of this century. Scholars in most disciplines, and even psychologists themselves, have had doubts about attempts to study cognitive functioning. In the *Scientific American,* Barron (4) reports sending letters to writers asking them to contribute to studies of creative thinking. He comments as follows on the replies:

> In trenchant and not particularly orderly prose, about a fifth of those who responded to our original letter pointed out the intrinsically evil character of psychological research. The objections to such research are mainly on these counts: it is vivisection; it is an expression of the effort of organized society to encroach upon the individual and rob him of his freedom; it is presumptuous because it seeks to describe and to understand what is intrinsically a mystery.

The suspicion of studies of thinking has extended beyond artists, writers, college professors, and atomic scientists to psychologists themselves. Despite the brilliant exceptions of James, Thorndike, and the transplanted Lewin, American psychologists in general have been wary of studies of mental life. We have careful laboratory investigations of conditioning eye-blink and elegant procedures for recording the maze-running ability of rats, but we have often shied away from the study of the complex intellectual life of children and adults. This has probably not been true of European psychology to nearly the same degree. The Gestaltists, and Burt, Bartlett, and Piaget have been concerned with cognitive processes. Here in America, as Edna Heidbreder put it, we have not always been asking the important questions about human behavior—or at least not until quite recent times. Within the last ten years, however, there has been a discernible shift of emphasis in psychological research toward some of the many phases of intellectual functioning.

It is now about ten years since I attempted to put together, in some sort of organized fashion, the scattered work of the last sixty years on higher mental processes. In the book *Children's Thinking* (45) I agreed with Johnson (30) that, in surveying research on children's thinking, it is possible to distinguish between the materials of thinking, which are multitudinous, and the processes of thinking, which are very few. I suggested that it is feasible to describe, and to some extent to discover, unique characteristics of each of six types of thinking. These categories I am using in this article because I believe they all can be applied directly to the learning of lan-

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The late Dr. Russell was a Professor of Education and Psychology at the University of California, Berkeley, and a past president of The National Council of Teachers of English. This paper is slightly adapted from an address on the same subject given at a conference on "Reading and Thinking" at the University of Delaware.

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guage abilities and especially to learning to read, the area from which my examples will be drawn. Here then is the hypothesis —that most thinking behavior can be categorized into one or more of the six categories: perceptual thinking, associative thinking, concept formation, problem solving, critical thinking, and creative thinking. It is not the purpose of this article to be taxonomic—to define and distinguish these types—although this can be done. Instead, I should like to indicate a few oustanding researches or research results in the various categories, with an occasional hint of how these may be applied to the process of reading. There are, of course, many other labels that could be used—thinking has been described as relational, fluent, logical, structural, scientific, evaluative, inferential, deductive, and artistic. Spearman (51) wrote of eduction of relations and correlates. Guilford (22) uses terms like convergent and divergent thinking. Bruner (7) distinguishes between intuitive and analytic thinking. The possibilities are many but this paper uses six labels which are particularly relevant to the work of the teacher.

1. *Perceptual Thinking*. Perceptual thinking is learned; it goes beyond relatively unlearned sensation to an awareness of objects and events which are interpreted. It may be relatively simple as in pitch discrimination or complex as in a recognition of emotional meanings. It may be objective as in naming a primary color or subjective as in interpreting pictures or in the "Johnson image" during an election. Perceptual research flourished early in this century, moving from introspection to nicely controlled laboratory responses. Applications to letter, word, and phrase recognition are obviously related to reading and therefore researches and theories of perception probably need more attention in educational psychology.

Some of the theories of perception are physiologically based as in Hebb's (24) cell-assembly theory and some are functionally based as in Helson's (26) adaptation level or Brunswik's (10) perceptual constancy. The last ten years has seen emphasis on the influence of set, attitude, and other personality factors in perception as in the work of Ames (2), Bruner and Postman (9), and Blake and Ramsey (5). The well-known Ames' studies illustrated the influence of habit in visual perception of space relationships. The Bruner-Postman three-step cycle of expectancy, input of information, and checking of hypothesis would seem to offer many leads to reading research. For example, they say the stronger the set or hypothesis, or category, the less information needed to confirm it, the more needed to change it. The Blake and Ramsey book explores some of the relationships between perception and personality.

More recent summaries of research on perception are represented by Wohlwill's (60) review of the development of perception abilities in childhood and by the Gibson and Olum (18) chapter on experimental methods of studying perception in children. They find that the research on the question of part *versus* whole discrimination is inconclusive with results depending upon the materials used in the experiments. Langman (33) listed sixteen visual perception skills and five auditory perception skills needed in reading and added seventeen generalizations used in letter-sound analysis. Gibson (19) studied the role of grapheme-phoneme correspondences in perception of words and concluded that pseudo-words constructed according to rules of invariant spelling-to-sound correlation are perceived more accurately in tachistoscopic presentation than their matched words with variable spelling-sound prediction. Gibson also reports several other studies in the volume by Levin *et al* (34), which contains accounts of twenty-two separate studies, most of them dealing with some form of perception. In the collection Levin has two other studies of variable grapheme-phoneme correspondences and, in addition to the study mentioned, Gibson deals with the perception of letters.

The analysis of some of the more complex perceptions of children as they read paragraphs or stories is currently not an active area. Earlier studies by McKillop (39), Groff (21), and others illustrated that perception of the meaning of paragraphs may be affected by attitudes toward the subject matter read. Reed (44) has traced some of the relationships between personality scores and reading choices in the sixth grade. Studies are needed, for example, of children's perceptions of different types of fictional characters or of different kinds of poems.

2. *Associative Thinking*. Associative thinking is a broad term which includes such theories or constructs as conditioning, S-R bonds, primacy, and reinforcement. With the exception of the study of reinforcement, research on this topic has declined from the interest of the 1920's but there seems little doubt that the label describes much thinking of a rather routine sort in which simple relationships are established. It may be the most accurate description of children's learning names of letters or a sight vocabulary.

Both McCreary (38) and Otto (43) have studied associative learning in relation to reading ability. A number of other studies within this framework have been reported in the new publication *The Journal of Verbal Learning and Verbal Behavior*.

In his book, *Learning Theory and Personality Dynamics*, Mowrer (41) extended the concept of association in a two-factor exposition to include both contiguity theory and drive-reduction theory. Current interest in the area is also evident in Skinner's reinforcement theory and its application to teaching machines. In the Soviet Union, Luria (36) is continuing the Pavlov tradition with studies of children's thinking based on theories of conditioning and association.

3. *Concept Formation*. Research in this area goes back at least to the 1890's and G. Stanley Hall. It has always been pursued with some diligence and has recently fluorished with even more prominence as certain scientists, mathematicians, and scholars in structural linguistics have become interested in the concepts children can learn. One problem nagging today's primary teacher is whether young children understand more than they did a generation ago as a result of television, travel, and other phases of modern life. Another problem in curriculum planning is that of selection of the most important concepts in a discipline. A third one concerns the current tendency to introduce concepts earlier; children can learn them sooner than we once thought but is the earlier gain worth the extra effort?

Research on concept formation has been summarized in general articles by Russell (46) and by Carroll (12) and in specific subject-matter fields by research workers with interests in particular areas. The research on concepts can be divided into three categories: 1) concept discovery, 2) gradual concept attainment and enrichment, and 3) children's knowledge of concepts at various age levels. Carroll believes the first phenomenon is the result of inductive thinking, the second of deductive thinking. The first is usually used in laboratory experiments; the second and third are closely related to the usual teaching and learning procedures in school.

The laboratory studies of concept discovery began with the work of Hull (27) in 1920 on learning nonsense names for pseudo-Chinese characters. This type of study was continued in the 1940's by Heidbreder (25) and expanded in the book, *A Study of Thinking* by Bruner, Goodnow, and Austin (8). Bruner hypothesizes that the subjects use different "selection strategies" and "reception strategies" in sorting out a sequence of events or group of examples so they can categorize them. He uses such terms as simultaneous-scanning, conservative-focusing, and focus-gambling to describe ways the category may be established. In many of his more recent books Piaget has been concerned with concept discovery in simple science experiments. Although the relationship between concept discovery and the reading process is not clear, Kress (32) has shown that there are differences between good and poor readers, who have been matched on general intelligence, in the ability to discover concepts in some of the well-known, clinical type, non-verbal sorting tests. The retarded readers preferred concrete to functional or abstract methods and scored lower on versatility and flexibility in concept formation.

The second main area of concept acquisition seems to have much significance for reading instruction. Undoubtedly many children beyond the ages of seven or eight learn many concepts, at least partially, by reading about them. The series of studies by Welch and Long (58) suggest that children can use a two-step hierarchy between two and four years and that most kindergartners can grasp a three-step hierarchy (people-man-soldier). In the spiral curriculum or through reading, children may add "layers of meaning" to their concepts. The most important work in the area of concept learning is that of Piaget who is also concerned with the third division of concepts typically known at various developmental levels. His numerous experiments have been summarized and evaluated in part by Flavell (16) and by Hunt (28).

There are scores, perhaps hundreds, of respectable investigations of concepts known, or not known, at various stages. For example, Russell (48) has summarized some doctoral studies at the University of California on the development of social concepts, conservation concepts, the self concept, the concepts of liberty and justice (as contained in the Pledge of Allegiance), concepts of God, and concepts understood by middle class and culturally deprived children. Among other things, in *The Measurement of Meaning*, Osgood (42) suggests the importance of connotative meanings and personality factors in any analysis of a store of concepts.

Such investigations raise theoretical questions of interest. For example, if certain concepts, as in mathematics or science, are not typically grasped at some age level, should the teacher, forsaking all others, make strenuous efforts to have the children understand these concepts if they have been labelled important by the mathematicians or scientists? Since some concepts seem to be harder than others, but also more fundamental than others, in what sequence should concepts be studied? A third question is whether children, adolescents, and adults think alike or differently in concept formation. There is considerable agreement in the literature that thinking is similar at all levels. In *The Process of Education*, for example, Bruner (7) writes of a central conviction "that intellectual activity anywhere is the same whether at the frontier of knowledge or in a third-grade classroom" (p. 14). On the other hand, Piaget believes that the preschool child relies on what he calls "intuitive thought" based largely on perceptual experience, that the child of elementary school ages shifts into a stage of "concrete operations" or ways of getting information which begin with the objective world but are internalized and symbolized. It is not until eleven or twelve years, Piaget believes, that the child becomes capable of "formal operations," of understanding "reversibility," or grasping possibility as effectively as reality. It is therefore not until this stage, Piaget believes, that the child can fully grasp the abstractions of mathematics or physics or other disciplines. These problems are examples of some of the questions about concept formation which must be studied in relation to the whole curriculum, including reading.

4. *Problem Solving*. The psychological view of problem solving is one of a complex operation involving several specific types of thinking. Problems may exist in any field, including those on the printed page, where there may be a question for the child of deciphering strange words, of grasping an author's argument, or of judging a fictional character. Modern psychology still accepts Dewey's (13) classic five steps in problem solving but regards them as a general, somewhat idealized picture rather than an exact description of some of the frustrations and circumlocutions of the individual who cannot find an immediate solution. For example, today we use many labels to describe the solver's behavior. These include 1) relational thinking (Maier's combining the essentials of two isolated experiences), 2) logical reasoning (Guilford tests for this factor), 3) rigidity (Werner and Kaplan and Bloom and Broder find this a useful concept, but some research indicates it is a specific rather than a general trait), and 4) anxiety (Fattu reports a negative relationship between anxiety and number of problems solved). A number of studies such as that of McNemar (40) have found that good problem solvers excel poor problem solvers in ability to overcome an induced set and to do deductive thinking. Harootunian (23) found that reading ability, intelligence, judgment, and problem recognition were important predictors of problem solving ability; closure, word fluency, and ideational fluency made little independent contribution to variance in problem solving ability.

As indicated elsewhere, the research suggests that problem solving behavior varies with 1) the nature of the problem, 2) the methods of attack used, 3) the characteristics of the solver, and 4) the group or social factors in the situation. Problem solving has been studied most thoroughly in science situations (14, 29) and with mathematical materials (Wertheimer, 59), but each of these four areas may apply in the reading situation. For example, the first (the nature of the problem), might include the numbers of unknown words in the selection, the second (methods of teaching), the pupil's ability to outline, the third, the attitudes of the reader to the content, and the fourth (influence of the group), may be of interest in terms of current views about individualized and group reading. What we know about the dynamics of groups (6, 31) has not been tested in groups organized for reading instruction. But a number of writers including Stauffer (52) have shown that problem solving in the areas of word recognition and simple comprehension may be encouraged as early as the first grade.

5. *Critical Thinking*. From the psychological point of view, critical thinking is the most dubious of the six labels by which I am attempting to summarize research in thinking. Usually it is part of some other process, as in evaluating the kinds of evidence collected in problem solving or judging the original result in creative thinking. The nearest the psychologist comes to allowing the term is in his use of the word *judgment*. Educational writings, on the other hand, are full of the two words, and the term "critical thinking" is especially

the darling of the social studies people. One trouble in educational writing has been that critical thinking has had so many meanings. It has been made synonymous with the ability to abstract and organize information, to draw inferences, to search for relevant materials, to evaluate data, to compare sources, to employ a from-Missouri attitude, to distinguish fact from opinion, to detect propaganda, and to apply the rules of logical reasoning (49). Perhaps the time has arrived when we should be critical of our use of the phrase "critical thinking."

As a research area, the field of critical thinking accordingly suffers from this lack of precision. The exploratory study of Glaser (20) is still about the best at the high school level. A number of studies of propaganda analysis are closely related to reading. The bulletin published by the National Conference on Research in English and entitled *Critical Reading* (50) is correctly subtitled as an introduction. Some of the confusion in terms is shown in the book from England by Abercrombie (1) entitled *The Anatomy of Judgment* and subtitled "An Investigation into the Processes of Perception and Reasoning." This may be one more bit of evidence that psychologists confuse terms, or the whole picture may be interpreted to mean that critical thinking is not a separate process so much as part of other cognitive functioning. Like some psychologists in this country, Abercrombie reasons that in receiving information from a given stimulus pattern we select from the total amount of information available and from our own store of information. Thus the perceptual process involves selection and judgment with the subject sometimes deliberate, sometimes unaware of what he is doing. Abercrombie used a tape recorded, group discussion method with university students and found that some of the factors influencing judgment became apparent and the judgments improved. The group discussion method may be one way of getting at assumptions or preconceptions and thus of improving critical thinking.

Recent attempts to clarify the concept of critical thinking have been made by Ennis (15) who divides the activity into some twelve operlapping categories along logical, critical, and pragmatic dimensions, and by Saadeh (49) who related his analysis to some of the rules of logic. Saadeh taught critical skills to sixth graders with considerable success as did Lundsteen (35) in another investigation of the possibility of teaching critical listening abilities.

6. *Creative Thinking*. In these days of emphasis upon intellectual attainment, curricular rigor and the "pursuit of excellence," creative thinking, and creativity are fashionable topics. In addition to individual researches, well-supported team studies are being made in a half-dozen centers throughout the country. Guilford includes creativity in his studies using factor-analysis at the University of Southern California. At Chicago, Getzels and Jackson (17) have differentiated between adolescents scoring high on intelligence tests and adolescents rated as creative, but have not studied cases where the two groups overlap. In Berkeley, MacKinnon and his associates (37) have a series of studies of personality factors related to creativity in various professions, and in Minnesota, Torrance (56, 57) is heading work on a group of studies more closely related than most to creative behavior in classroom settings. Such studies assume that creative thinking is not the province of a gifted few but exists on some sort of continuum for much of the population. In addition to certain skills, production of originality in some of these studies seems to involve three general factors which may be labelled perceptual, integrative, and emotional. MacKinnon finds

different amounts of these in artistic creativity, scientific creativity, and what he terms "overlapping" creativity. Artistic creativity involves externalization of an internal state; emotion and personality may be heavily involved. In scientific creativity the scientist functions as a mediator between an external problem and its solution and is, presumably, less involved emotionally. Creativity in the "overlapping" category includes performers, interpreters, and high-grade individuals in such pursuits as architecture and engineering.

In some of their research memoranda, Torrance and his students report trouble in establishing the reliability of his tests of creativity in elementary school children but have certain findings about the personalities of children rated as creative. As some of us might suspect, the so-called creative child is not well accepted by his peers or his teachers in the first four grades; he is often rated as limelighty and bossy. By the sixth grade a better status has usually been achieved.

On the positive side, the upsurge of interest in creativity may be documented by the publication, within five years, of at least six substantial volumes collected by various editors and reporting research in various aspects of creativity. Alphabetically by editor or author, these include Anderson's *Creativity and Its Cultivation* (3), MacKinnon's *The Creative Person* (37), Stein and Heinze's *Creativity and the Individual* (53), Taylor's *Creativity: Progress and Potential* (54), Taylor and Barron's *Scientific Creativity: Its Recognition and Development* (55), and Torrance's *Creativity: Second Conference on Gifted Children* (56). Combined with scores of research articles, the books represent increasing interest in, instead of final conclusions from the empirical study of creativity.

In the above research, two important problems are unsolved: the unique characteristics of creativity in childhood and youth, and some valid and reliable measures of creativity itself. As one reviewer put it, "creativity is a construct in search of a generally acceptable objective referent." Most of the tests of creativity have been developed by Guilford and his associates or adapted from his work. These lend themselves to factor analysis, which may be regarded as one step on the way to complete understanding, but some of them do not seem to correlate highly either with retest scores, with teachers' or supervisors' judgments of creativity, or with rating of students' creative products by independent judges.

The books and articles are samples of work in progress which suggest four domains of research in creativity: 1) the nature of the creative process, 2) the characteristics of the creative person, 3) the qualities of creative products, and 4) the social-cultural milieu, including classrooms, which block or foster creative responses. The whole area of creative thinking thus bristles with problems. Is there such a thing as teaching creativeness? Does creativity in play, rhythms, and language occur before creative thinking about social or scientific problems and are they different things? What can teachers do to achieve some sort of balance between conformity and spontaneity in the classroom? How can we get more "discovery" into a reading lesson? What are the places of production *versus* appreciation in reading and in other curricular areas?

The act of reading has usually been regarded as a receptive process rather than a creative one. There seems to be some justification, however, for the use of the term "creative reading" to signify behavior which goes beyond word identification or understanding of literal meaning to the reader's interpretation of the printed materials (47). Such reading may be productive of new ideas, critical of old ones, or appreciative of the art of literature. Research studies suggest that certain mechanics of reading must be well in hand before the child or adolescent achieves these higher levels of reading and that they, like the skills, can be developed by the right kinds of instruction.

Conclusion

The above examples suggest that language abilities should be defined not merely as perceptual skills nor as the ability to grasp a communication, nor as competence in solving verbal problems. Probably all types of thinking are involved in the learning and use of language and these I have subsumed under six labels. Other general descriptive terms could be used and more precise designations of specific verbal behavior are undoubtedly needed. Furthermore, this account neglects such topics as emotional factors in thinking, the role of memory, and attempts to derive a comprehensive theory or model of thinking as in the work of Burt (11) or Guilford (22). It is probably not too important in the study of the reading process, from which the examples are drawn, to distinguish between the types of thinking, here called perceptualizing and conceptualizing. Behavior which involves the apprehension of events or objects such as printed symbols may be profitably conceived as a categorizing, whether perceptual or conceptual. As Bruner has put it, "There are examples in which it is almost impossible to differentiate perceptual and conceptual categorizing, notably in language learning" (8). In addition to its use in the discovery of concepts, reading seems to be one of the best ways we have of deepening and enriching concepts.

Similarly, there is overlap of critical thinking with the processes of problem solving and creative thinking. A child or a scientist must be critical of his proposed solutions to a problem. An adolescent or an adult must sometimes be critical about his creative production, whether an original story or an interpretation of A. E. Housman. Despite this blending of critical thinking into problem solving and creative thinking, it is my bias that some aspects of critical thinking can be taught directly as such. (See the article by Stauffer in this series.) Similarly, I believe the other five types of thinking can, to some extent, be isolated and taught in relation to the school curriculum, including reading.

In reading instruction of the past, most of a reading teacher's time and energy have gone into perceptual aspects of word identification and conceptual responses to literal meaning. These are necessary bases for more sophisticated approaches to reading, but perhaps the time has come when we can use our psychological knowledge of the processes of problem solving and critical and creative thinking to help teachers develop a more demanding set of goals for reading instruction.

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Form Consciousness, an Important Variable in Teaching Language, Literature, and Composition

Teachers of English have long considered form and content to be complementary attributes of language, literature, and composition. Much classroom time is devoted to studying interrelationships of the two, so much so that some teachers would even argue that form and content are inseparable and that the structure or form through which ideas are communicated actually defines in large measure the nature and meaning of the ideas themselves.

During recent years, an increasing number of scholars have interested themselves in the formal qualities of language as distinct from the meaning of language. Thus the structural linguists separate the linguistic meaning of a single utterance from the semantic meaning; the literary critic strives to describe the aesthetic form of a literary work; the educational psychologist strives to identify individual variation in the ability to perceive form in language. The concern with form, shape, and recurrent pattern in communication is truly interdisciplinary. Psychologists, rhetoricians, and literary critics each have much to contribute. Although present knowledge about the ways in which individuals perceive form in language is fragmentary in many respects, studies bearing on the topic may be found in several fields. This article considers selected findings with respect to the processes of perception and to what is known about consciousness of form in simple spoken dialogue, in written discourse, in literature, and in related art media.

The Perceptual Process

Allport has reviewed the way in which the perception of structure or form is viewed in thirteen separate theories of perception (2). He finds form perception central to every theory and advances numerous generalizations concerning form perception basic to all positions. Hilgard further suggests that the emphasis upon organization and perceptual patterning so characteristic of Gestalt psychology (and of importance in any discussion of individual perception of form) has been embraced by associational psychologists in their work with problem solving and creative thinking (35). Thus concern with the perception of form appears central to many of today's perceptual theories. Some of the recent research bearing on perception has been summarized from different points of view by Rosenstein (68), Carroll (10), Fearing (21), Gibson (27), Suchman and Aschner (85), and Wohlwill (89).

Reporting on a series of experiments testing the effect of organization on perceptual recall of visual form, Glanzer and Clark advance a hypothesis which may

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have significant implications for the perception of form in literature and composition (29). They suggest that in perception, restricted primarily to visual perception in their work, subjects translate perceived information into words before formulating final responses. Any interference in the translation of the pattern perceived prior to verbalization interferes with the accuracy of the final response. The hypothesis suggests the possibility that individuals do not finally comprehend total pattern, even visual patterns, until they identify and develop their percepts in words. It further suggests the complexity of assisting individuals to perceive form in literature in view of the interference likely to occur during the process of reading. Squire's discovery that adolescent subjects reading short stories tend to delay judgment of overall aesthetic form until their reading is completed offers some evidence to support Glanzer and Clark (81). The hypothesis offers researchers the further suggestion that the length of verbalization elicited by any stimulus offers a measurable, objective index of form perception.

Several studies suggest the ways in which concept development occurs in children. Concepts of form, like generalizations associated with meaning emerge slowly from both deductive and inductive processes out of the percepts, memories, and images resulting from each individual's reorganization of experience (11). Indeed simple percepts of form appear to be among the earliest percepts to develop (70). During childhood, the ability to perceive form, like other abilities of perception and abstraction, probably varies more with the experiences of children than with their intelligence (85). As Rosenstein says,

> A child may see, feel, or experience an object appropriately, more in accordance with some habit rather than in accordance with the actuality of the situation. The process of inductive thinking, which involves a search for common attributes in a given group, may easily go astray because the process of generalization is neither understood nor consciously controlled by the child. Even more, a wrong generalization may easily be accepted by the child because he has no related experiences by which to check his conclusions (69).

Planned experiences with perceiving form in language may thus influence the child's awareness of form, but additional research is needed to suggest whether such planned experiences in language – in sentences, paragraphs, and literary selections, for example – ultimately assist the individual in developing greater consciousness of form. Dienes reports that extensive and varied experiences with related abstractions in mathematics contribute to strengthen overall generalizations (18), but evidence does not yet indicate clearly that such findings apply equally to the language field. Certainly supporting such an hypothesis is Fearing's belief that the structuring process involves isolating, organizing, understanding, and ultimately retaining overall cognitive structures or "schema" which can be drawn upon later to organize additional percepts (21). Gibson says, however, that this theory of the overall concept or image as prototype for recognition conflicts with an equally widely held view that perception results from the child's increasingly differentiated response to distinctive stimuli, such as even to individual phonemes or graphemes or to minute combinations of the two (27)

Russell suggests that conscious efforts to encourage the perception of form in language may begin too early. In summarizing what is known about the analysis and synthesis of aesthetic form – in music, painting, literature – he reports that children's aesthetic concepts tend not to reach toward the abstract principle of unity in art (70). However, Carroll writes that after age six, children appear to learn little in language but vocabulary and school-imposed standards of language usage (10).

The context in which individuals are required to perceive form also appears to be important. The total framework of the learning situation appears to affect perception (77). So does the time required for perception. Objects, events, or ideas that need to be associated and fitted into any structure must occur close together and be presented in such a way as to accentuate their similarities (21). Thus learners should have less difficulty in perceiving the form of a well-written paragraph than the overall pattern of an essay involving several paragraphs. Of even greater significance in the classroom situation is the suggestion that any interruption or lengthening of the time sequence required for perception threatens to interfere with the learner's ability to perceive overall pattern. A child presumably can better perceive form in a poem or short story if these are read without interruption. Time becomes increasingly important, states Hartman, when overall pattern is achieved and made meaningful by metaphorical or illustrative stimuli (34), such as apparently occurs when the overall structure of a poem like Shelley's "Ode to the West Wind" is perceived through its metaphorical unity.

Clearcut studies of form consciousness in language are not easily identified. Russell and Fea recently observed that despite the multi-faceted nature of abstraction and generalization involved in concept formation, much research has been single-faceted (72). Also, many experiments in concept formation have been concerned less with the teaching of concepts of any kind than with the determination of the concepts children have already acquired. Yet existing studies suggest that concepts of form, like other concepts, can be acquired in two possible ways: they can be taught consciously by the teacher presenting appropriate stimuli and assisting children in their generalizing; and they can be discovered by the children themselves through "hit and miss" experimentation (68).

Form in Linguistic Utterance

For several years researchers in linguistics and in psychology have concerned themselves with the study of the single utterance or the single statement. Brown emphasizes how language provides categories for ordering and classifying experience (7, 8). Miller and Isard demonstrate that both syntactic and semantic rules are involved in the perception of language (56), but it is with the syntactic, formal elements that this paper is concerned. Psychological studies indicate clearly that language is more easily recalled when it occurs in formal units—statements, phrases, clauses, or single utterances, *i.e.*, in the context of some identifiable form (28, 55, 57). Linguists like Sapir have demonstrated that within the English statement, certain words, traditionally called verbs and nouns and their modifiers, carry essential meaning; that certain other words, sometimes called articles or intensifiers, offer structural clues to the meaning (73). The study of the structure of the English statement, unencumbered by attention to the sense, can sometimes help pupils to develop understandings about the ways in which ideas are presented. Glanzer points out that the "unit of communication" in English is not the single word but combination of multiword signals which include both meaning words, such as nouns and verbs, and signal words (28). Most linguists agree that individual words function only in combinations and that language is perceived and studied in clusters. Loban used both phonological units, identified by inflection, stress, and pause in his subjects' voices; and communication units, identified by semantic elements, in his study of language development (44, 45).

In a discussion of recent educational research involving the insights of generative grammar, Postal suggests that the structure of the English sentence involves a highly complex, abstract series of elements which can be related to actual utterances only by a set of highly structured rules. He finds that views of language learning which restrict attention on the one hand to gross phonetic properties or on the other to such gross psychological theories as generalization or stimulus-responses fail to account for "the fantastic feat by which a child with almost no direct instruction learns that enormously extensive and complicated system which is natural language" (65). Postal assumes that generative grammarians will ultimately find a basic linguistic system underlying all language performance.

Structural studies of language review the importance of the formal structure of the English sentence. Hook and Matthews, for example, report that 96 percent of all English sentences, spoken or written, may be reduced to four basic sentence patterns (38). Fries revealed that the ability to manipulate these basic patterns and achieve variation in sentence structure distinguishes verbally competent adults (25). In his study of language development of children during elementary years, Loban substantiated his finding with respect to the ability of children to manipulate basic sentence patterns. "Although differences in structural patterns are *not* notable – with the exception of partials and linking verbs – very important differences do show up in the dexterity with which subjects use elements within these structures.... Not pattern but what is done to achieve flexibility within the pattern proves to be a measure of the effectiveness and control of language at this level of development" (44).

Awareness of the form of English sentences is thus increasingly seen as a foundation for effective communication, but awareness of sentence form, not an awareness of grammatical generalizations. Strickland, who presented evidence to indicate that preschool children use in their speech all of the complex sentence forms which they will ultimately use in their writing, notes that, "Children's concepts of many, if not most of the things and ideas they encounter, develop without benefit of definition..." (83). Definitions of linguistic terms may be more confusing than helpful and do more harm than good. Rather than rely on definitional approaches in developing consciousness of sentence form, Strickland advises teachers to build on children's interest in manipulating language, beginning with a sentence the child has used, stripping it down to its basic subject and predicate (the "irreducible minimum which can be called a kernel, nucleus, or core"), and encouraging children to add elements of expansion – the movable parts of the sentence which can influence emphasis depending upon their placement.

Studies of the language development of children summarized by McCarthy indicate that mean sentence length has been the most reliable and objective measure of linguistic maturity (51). Such studies have concentrated on the formal qualities of written language rather than on speech, which according to recent findings reflects children use far more complicated linguistic patterns than does their writing (45, 83). LaBrant discovered that the clauses written by grade school children become longer as writers mature (43). Hillocks recently reported ability to subordinate and compound were characteristic of maturity (36). Utilizing transformational approaches, Hunt analyzed the prose of fourth, eighth, and twelfth graders and reported that major growth occurs in the nominal structures rather than in adverbial modifiers. He found older students able to incorporate more varied grammatical structures within a single grammatically independent unit; *i.e.*, able to incorporate a larger body of thought into a single intricately related sentence organization. Because Hunt discovered that verb complements, unlike nominals, apparently do not increase with age in sentence-combining transformations, he hypothesized that his study revealed the "growth buds" for sentence transformation. His work demonstrates the potential value for research in language learning of modern transformational theories of English grammar.

Recent linguistic scholarship also reveals attempts to identify basic spelling patterns which may be taught to children. Fries reports modern English spelling to be primarily a system of a comparatively few arbitrary contrastive sets of spelling patterns which efficient readers need to learn to master language signals (26). Hall also suggests that phonemic patterns may be identified, and Strickland sees a program of spelling instruction based on identification of such patterns to offer a fruitful approach to teaching spelling (33, 83). Quite possibly these new attempts to improve children's recognition of spelling patterns based on modern phonological analysis may prove more successful than earlier attempts to teach classifications of spelling words.

This brief review of selected studies in linguistic analysis and psychology suggests only the possibilities for research. As increasing numbers of psychologists inform themselves about grammatical analysis and as more grammarians develop interest in empirical studies, the potential value of such scholarship is manifest. Structural analysis of the English sentence already has yielded important insights with implications for teaching. Perceptual studies utilizing the insights of transformational theory may prove even more basic.

Form in Composition

The ability to perceive form is basic to good composition. Indeed the traditional principles of effective writing – unity, coherence, and emphasis – all point to the significance of imposing an overall structure or form on the ideas communicated through the paragraphs or longer units of discourse.

Research indicates that the ability to organize is an important variable in distinguishing between good and poor writers. The good writer is one who worries about organization, about not being specific, about not having a clearcut purpose, about not being direct and to the point; whereas the poor writer concerns himself with such organization as the slant and alignment of his handwriting, and with mechanical matters not directly related to the problem of organizing the expression of ideas (4, 16, 80). At one major university some years ago a faculty committee studied the writing of college undergraduates and concluded that the ability to organize was basic in all good writing, that mastery of the techniques of grammatical usage seemed to be a corollary of ability to write well (41).

Russell and Fea report that purpose will govern whether a child sees the overall idea or form of a paragraph (72). Studies are needed to ascertain more clearly whether training in such awareness helps students as they compose.

Research suggests that those who are able to observe form in their own writing are best able to perceive it in the writing of others (4). One effective way to improve a writer's control of paragraph form is to provide a study of good models (74), although the effect of such instruction has not yet been carefully studied by research. Parker does suggest that awareness of topic sentences and concluding summaries, *i.e.*, awareness of basic paragraph form, increases the comprehension of a student's reading of expository prose (62). Miles analyzed the writing of thirty college freshmen capable of reading Thoreau, Jung, Freud, Plato, and Reisman, and concluded that many bright students fail to relate their basic ideas to any pattern of organization (53); that is, they fail to predicate their ideas by expressing them in statements which can be expanded. For many students, ideas are equated with abstract words or phrases rather than with predicated statements. Such students fail to associate the concept of an idea with the concept of the statement, thus are unable to see the essential connection between the predication made, and the arrangement of the supporting illustration which follows. The importance of form and predication in paragraph development has been carefully discussed by Evans who argues that without the imposition of formal pattern of expression, students learn to write but not to compose (19).

Form is one of several variables which appears to influence writing ability. In a study of factors influencing success in writing, Diedeush, French, and Carlton studied evaluations of selected specialists on writing — teachers, professors, editors, and writers (17). They discovered five overall factors which influence judgment: content, form, diction, flavor (or style), and mechanics. Moreover, they reported that readers vary in the emphasis which they place on various factors. Many teachers, regrettably, were found to confine their corrections and annotations largely to mechanical matters, rather than to consider other factors as well. Inasmuch as a reasonably balanced attention to all factors is as clearly desirable in annotating papers as in organizing instructions, the study offers important leads for researchers and curriculum specialists concerned with the problem of balance. In a statewide survey of practice in teaching composition, Meckel, Squire, and Leonard reported the teachers most successful in teaching composition to be those who emphasize the clarification of ideas. This clearly suggests the importance of form and structure in effective writing and the need for providing formal analysis as part of the instructional program. In an interdisciplinary seminar representing scholars in several fields, Sebeok and others studied the nature of style in language and identified a number of formal qualities (75). An interesting new approach is that of Christensen who found four qualities to determine the effectiveness of expression in writing: the principle of addition, the direction of modification, the level of generality or abstraction, and the texture or density of any sentence in terms of its stylistic qualities (13, 14). Christensen's work has been called the beginning of a generative rhetoric of English prose, because it stems from the concern with generating ideas first expressed by transformational grammarians. If extended by additional study, his work may provide not only overall guidelines for effective instruction, but methods of identifying and isolating selected characteristics of English prose style for separate study. For example, what differences can we find in the texture or density of children's writing at different age levels? By applying Christensen's analysis to selected samples of writing, researchers may provide helpful answers.

Concerned primarily with the findings of empirical research, this paper necessarily avoids any extensive discussion of several other recent attempts to provide rhetorical analyses of English prose (5, 6, 32, 47, 66). However, any researcher concerned with stylistic matters needs to be aware of such work.

Form in Literature

To a considerable extent, the form of any literary work determines its aesthetic effectiveness. On other factors perhaps, such as the universality of the idea, may depend ultimately our assessment of the value of the work, but it is form more than any other quality which determines whether a work is literature at all. And it is awareness of the importance of form, perhaps more than any other factor, that has led curriculum specialists to recommend against permitting the study of fragments, snippets, or adapted versions of literature in the classroom (15). Consciousness of form in reading any literary work is important.

Russell's review of research on the impact of literature shows how fragmentary is all knowledge in this area, including knowledge about perception of form in literature (71). Smith has also summarized some studies of appreciation (79).

Studies of responses to literature have yielded some insights. Richards analyzed misinterpretations of college readers of thirteen poems of unknown authorship, and discovered not only stereotyped responses and difficulties in comprehension, but also possible effect of general critical preconceptions and technical prejudgments, some of which reflected excessive concern with arbitrary notions of form (67).

Meckel found unfavorable student comments to Hugh Walpole's "Fortitude" resulted more from ideas in the literary selection than from reactions to form or style (49). His findings tend to be substantiated in part by the Wilson review of college readers to three novels (88).

Squire analyzed responses of fifty adolescent readers to four short subjects and reported covariation of literary judgments (which deal with formal qualities) and emotional self-involvement responses. Fewer literary judgments occur while adolescents read the central portion of a story than occur before involvement or at the end of reading (81).

Burt discovered an age differential in the awareness of children of such formal qualities of poetry as poetic expression, rhythm, melody, and vowel music (9). He reports that younger children respond to poems largely in terms of story factors and that appreciation of other, more formal elements does not emerge until later years.

A series of studies indicated that although general factors may determine overall literary preference, a secondary factor related to consciousness of form in literature also influences responses.

Williams, Winter, and Woods applied five tests of literary appreciation to more than 200 children and adolescents and found that a general factor of literary appreciation, correlated with intelligence, accounted for 50 percent of variation in responses, whereas a second bipolar factor, accounting for 20 percent of the variance, separated readers preferring the objective, form-conscious styles of classicists from those who preferred subjective approaches of romantic school of writers (87).

Gunn subsequently identified a general aesthetic factor associated with such qualities as liking, emotional effect, mode of expression, appeal of the subject, and a bipolar factor distinguishing readers concerned with rhyme, word music, and rhythm, as distinct from those concerned with emotional effect, appeal of subject, and mental imagery (31).

Forman found free responses more helpful than responses elicited by specific questions in attempting to measure appreciation. He utilized three scales — elaboration of details to measure visualization, continuity and purpose to indicate comprehension of meaning and sequence, and character vitalization to measure response to literary figures (23). The correlation between scales was so high that he concluded that they measured a general appreciative factor.

Carroll attempted to quantify aspects of literary style by analyzing 150 passages of English prose in accordance with 29 adjectival scales covering major qualities and traits. His discovery of a factor called General Stylistic Evaluation indicating overall positive or negative evaluation appears to substantiate the earlier studies. Six independent dimensions of style were studied by Carroll: General Stylistic Evaluation, Personal Affect, Ornamentation, Abstractness, Seriousness, and Characterization *versus* Narration (12).

Recent studies of preferences for literature have been described by Peel who tested responses to thirty-one abstract patterns in terms of such criteria as rhythm, symmetry, lightness of tone, and lack of contrast (63). Peel's method for determining preference by relating specific determiners of preference to the liking choices of those investigated suggests a way of studying form consciousness in judging works or arts.

Peel, also, has described a use of Osgood's semantic differential to analyze preferences in terms of qualities in a work of art by applying a set of twenty scales including measures of vividness, depth, and clarity to selections from twelve major novelists (60, 61).

Peel notes that in applying methods used to analyze preferences for paintings to analyzing preferences for literary works, researchers must note that paintings evoke more or less instantaneous attitudes, whereas responses to prose and poetry often require longer reflection. Thus Peel's methods probably are most appropriate in studying reactions to short passages.

Not all studies of literary form of interest to teachers stem from empirical research. Contemporary literary criticism especially has yielded many valuable studies. For example, Goodman's analysis of the structure of literature focuses on formal qualities (30), as does Ohmann's attempt to identify recurring patterns of expression in the language of Bernard Shaw (59). Some critical writing combines concern for the formal qualities of literature; Fagan, for example, reviews field theory in the sciences and suggests extensions to the study of literature. His detailed analysis of a field approach to the novel *Storm* suggests a teaching dimension to literary studies which emphasizes symbolic unity (20).

After reviewing much modern criticism as well as the recommendations of specialists on the teaching of English, Walker identifies nine points of agreement concerning teaching the structure of literature:

1. The study of literature should include a careful analysis of the work to see what structural relationships exist.
2. The investigation of structure should be inductive (not with formula or list of structural elements in hand).
3. The structure of literature is what gives it unity or enables it to have a unifying effect.
4. Structure is the overall pattern of relationships that holds parts together.
5. The study of structure involves the study of form and content.
6. The study of structure should begin with a view of the whole.
7. The study of structure facilitates understanding and interpretation of literature.
8. The understanding of structure broadens the base of literary appreciation by enabling readers to appreciate literature not only for its appeal or meaning to them but also for the craftsmanship involved in its creation.

9. The study of structure facilitates transfer of ephemeral principles pertinent to literature, composition, and a process of investigation (86).

Walker found that specialists disagree on whether the purpose for studying structure in literature is to judge or to understand a work. He believes those influenced by the New Criticism of The Thirties and Forties see structure as an effective means of evaluation; others feel that understanding is the greatest value to be gained from study of a work's structure.

Form in Other Media

Perception of form is basic to the appreciation of all artistic expression. Whatever can be done to encourage perception of form in one medium of expression may reinforce and extend such awareness in others (39). Burt's research indicates, also, that an individual who is a good judge in one field is likely to be a good judge in another (9), although Nordberg warns that any visual stimuli have unique character of their own (58). The bulk of research suggests that young people who learn to distinguish beauty of form in one medium may transfer some of their awareness to expression in a related medium.

Studies of reactions to pictorial form have probably been more extensive than studies of such perception in literature and composition. The findings reported in such research suggest some interesting possibilities concerning form consciousness of other kinds.

Peel (1945), for example, found that adolescents prefer well-drawn designs, reflecting naturalistic principles, symmetrical designs, balanced patterns, and brilliant colors (64).

Siegel and Siegel (1950) found children about ten years of age able to conceptualize beauty in terms of material possessions and moral values, rather than aesthetic ideas (78).

French (1951) demonstrated up to the third grade a positive relationship between degree of structural complexity shown in children's own art and the structural complexity in pictures they prefer. In upper grades children prefer more complex patterns (24).

Morrison (1935) found that boys and girls of the same age do not differ in preference for structural organization of pictures but do in terms of subject matter (57).

Hochberg reports that pictorial communication of shape and form is not a simple learning shell but a process which occurs early in life and is related to how the individual learns to see life (37).

After analyzing the reactions of 77 nursery school children to ambiguous pictorial material, Amen reported that the direction of form perception in children moves from details to a larger whole (3).

Because such findings have been achieved with visual rather than verbal stimuli, they may or may not apply to perception of form or other media. However, researchers interested in the problems of form consciousness will consider reviewing and replicating some of these studies, substituting verbal stimuli for the pictorial.

Form may also be studied in relation to art form related to literature—the film, the television play, and the theatre. In a new study of the motion picture, Sheridan, Owen, Macrorie, and Marcus apply the approaches of textual criticism to the film and identify important formal qualities for classroom study (76). Attempts have been made to organize institutions in the humanities which relate expression in several aesthetic media. For example, the State of Missouri recently published a course of study on "the allied arts" which provides for instruction in the basic principles underlying and relating literature, music, painting, sculpture, and architecture (1). Among the elements common to most art media studied in the course are line, color, value, volume, texture, shape, and perspective for the space arts; and pitch, duration, timbre, and intensity for the time arts. Thus direct attention is being devoted to the perception of aesthetic form in some secondary school classes (37).

The Status of Research

Form consciousness then appears to be an important variable in teaching literature, language, and composition, even though present knowledge about its development is limited. This review of research and contemporary thinking on selected aspects of form perception only introduces an exceedingly complex subject. Much experimentation bearing on the perception of form occurs in research which serves other primary purposes. Classifications of empirical studies rarely list form perception as a distinct category. The researcher interested in exploring such problems is advised to read widely and deeply in the several disciplines mentioned in this article.

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Hilda Taba

The Teaching of Thinking

Educators have long said to themselves and to others that the proper business of school is to teach students to think. Yet this objective has remained a pious hope instead of becoming a tangible reality. A variety of factors have militated against developing a serious and well thought out strategy for helping students to become autonomous, creative, and productive thinkers.

Perhaps the most serious inhibiting factor has been the hazy conceptualization both of what is meant by teaching and what thinking consists of. Thinking has been treated as a global process which seemingly encompasses anything that goes on in the head, from daydreaming to constructing a concept of relativity. Consequently, the problem of defining thinking is still before us. The distinctions between the various types of thinking have been defective also. Even the more serious educational thinkers fail to distinguish the strategies of thinking, such as problem solving, from the basic cognitive process and skills, such as generalizing, differentiating, and forming concepts. These processes are the necessary ingredients of problem solving if this strategy is to amount to anything beyond sheer formality.

Implementation of thinking as an educational objective also has been handicapped by several questionable assumptions. One rather widely accepted assumption is that reflective thinking cannot take place until a sufficient body of factual information is accumulated. Teaching, which follows this assumption, stresses factual coverage and burdens the memory with unorganized and, therefore, rather perishable information.

An equally unproductive assumption is that thought is an automatic by-product of studying certain subjects and assimilating the end products of someone else's disciplined thought. Some subjects are assumed to have this power independently of how they learn or are taught. Inherently, memorizing mathematical formulae or the steps in mathematical processes is assumed to be better training than memorizing cake recipes, even though both may be learned in the same manner and call for the same mental process—rote memory (15).

The analysis of teaching suffers from similar difficulties. Teaching is still viewed largely as communication of knowledge, and often knowledge is equated with descriptive information—the "what," "who," and "when" questions are the main diet of classroom instruction. As a consequence the current methods of teaching tend to be shaped by this emphasis. Research on teaching has skirted the actual process of teaching and has concentrated instead on such matters as personal characteristics of good teachers and *a priori* criteria for rating effective teaching (6).

It is no wonder, then, that despite the widespread acceptance of thinking as an educational objective little consideration has been given to the ways in which learning to think differ from the ways in which students learn knowledge or content of various sorts.

Recent research is producing changes in both of these areas. Studies of cognition are under way, which promise a more

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precise analysis of the processes and of the psychological dynamics of the mental activity we call thinking. Some of these studies are concerned with styles of labeling (12), others with strategies of concept formation (2), and still others with what amounts to the styles in strategies of thinking (7, 10) Important as these studies are, as yet their results cannot be easily translated into the methods for modifying the ways of thinking. But at least they are opening up the possibility of a scientific approach to the analysis of thinking.

The development of thinking has received renewed attention also, as exemplified by the recent interest in the work of Piaget and his followers. Piaget's theories regarding the nature of thought and the sequences in the transformation of the patterns or modes of thinking have influenced such enterprises as Bruner's (3) analysis of the process of education and Suchman's (13) experiments with inquiry training.

Some progress is being made in the study of the teaching process also. Recent studies of teaching have focused on teaching as it occurs in the classroom instead of inferring its effectiveness either from *a priori* notions of good teaching or from the characteristics of good teachers. Studies by Hughes (8), Flanders (5), and Bellack (1) focus on describing and cataloguing the teaching acts and on inferring from these descriptions their impact on learning in general, on classroom climate, and on achievement.

This article is a description of a study of classroom interaction designed to examine the relationship between teaching strategies and the development of cognitive processes (16). The study, conducted under a grant from the Cooperative Research Branch of the U.S. Office of Education, focused on several hypotheses. The central hypothesis was that it is possible to train students in the processes of thinking, provided that the trainable cognitive skills could be identified.

The studies of thinking cited above seemed to have one difficulty in common as far as the application of their findings to instruction in the classroom is concerned. The findings regarding the styles of thought fail to shed light on the processes by which these styles are acquired or to describe the skills on which these styles are founded.

Another hypothesis was that under optimal conditions this training would result in an acceleration of the usual developmental sequence, such as the appearance of abstract or formal thought. The studies of the development of thought and intelligence by Piaget and the Geneva school (9*, 11, 14**) suggest that the evolution of thought takes place in three stages, essentially: 1) the sensory-motor stage or the preverbal intelligence; 2) the stage of concrete operations or thinking with objects and concrete events, which stage lasts from around two to eleven years of age; and 3) the stage of conceptual or formal thought which is established between eleven years of age and adolescence. There is a question, however, whether training would alter these age placements since the available data recorded the performance of untrained children, or those with only a minimum of training, such as in the study by Ervin (4). It seemed reasonable to assume that if both the curriculum and teaching strategies were addressed to the development of thought, formal thought could appear earlier.

The third hypothesis was that with adequate teaching strategies the possibility of abstract thought would be opened to students who are now considered to have too low an IQ to be capable of higher levels of mental activity.

The study was conducted in elementary classes which were using a curriculum in social studies that systematically stressed the development of an ability to generalize and to use generalizations productively. What remained to be done was to specify the necessary teaching strategies and to train the teachers in their use, in order to become adept at these processes themselves, and to learn how to induct children in the mastery of the required cognitive skills.

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*Chapter 6.

**Pp. 107-112.

The concept of cognitive tasks.

In an effort to arrive at teachable and learnable aspects of thought, three cognitive tasks were identified: 1) concept formation, 2) the development of generalizations and inferences through interpretation of raw data, and 3) the explanation and predicition of new phenomena by applying known principles and facts.

Concept formation. In its simplest form, concept development may be described as consisting of three processes or operations. One is the differentiation of the properties or characteristics of objects and events, such as differentiating the materials of which houses are built from other characteristics of houses. This differentiating involves analysis in the sense of breaking down global wholes into specific properties and elements.

The second process is that of grouping. This process calls for abstracting certain common characteristics in an array of dissimilar objects or events and for grouping these on the basis of this similar property, such as grouping together hospitals, doctors, and medicine as something to do with health care or according to their availability as an index to the standard of living. Naturally, the same objects and events can be grouped in several different ways. For example, hospitals, X-rays, and surgical equipment can be grouped together as health facilities, as type of services, or as indices of standard of living, depending on the purpose of the grouping.

The third process is that of categorizing and labeling. This process calls for the discovery of categories or labels which encompass and organize diverse objects and events, such as evolving the concept of a unit measurement from measuring with a cup, a yardstick, a plain stick, and a rubber band. It also involves the process of super- and subordination; that is, deciding which items can be subsumed under which category.

In classrooms this cognitive task occurs in the form of enumerating or listing, such as identifying a series of specific items noted in a film or reported by a research committee, then grouping similar things, and, finally, labeling the groups.

Interpretation of data and inference. Essentially this cognitive task consists of evolving generalizations and principles from an analysis of concrete data. Several subprocesses are involved. The first and the simplest is that of identifying specific points in the data. This process is somewhat analogous to the listing or enumeration preceding grouping. The second process is that of explaining specific items or events, such as why ocean currents affect temperature, why Mexico employs the "each one teach one" system in eradicating illiteracy, or why the way of life in California changed when its harbors were opened for free trade. This process also involves relating the points of information to each other to enlarge their meaning and to establish relationships.

The third operation is that of forming inferences which go beyond that which is directly given, such as inferring, from the comparison of the data on population composition with data on standards of living in certain Latin American states, that countries with predominantly white populations tend to have a higher standard of living.

Interpretation of data and formulation of inferences takes place in the classroom whenever the students must cope with raw data of one sort or another, such as comparing the imports and exports of several countries or analyzing and synthesizing the factors which determine the level of technological development in a given culture by examining the tools and techniques used in the production of goods.

Application of principles. A third cognitive task is that of applying known principles and facts to explain new phenomena or to predict consequences from known conditions. For example, if one knows what a desert is like, what way of life it permits, and how water affects the productivity of the soil, one can predict what might happen to the desert way of life if water became available.

This cognitive task requires essentially two different operations. One is that of predicting and hypothesizing. This process requires an analysis of the problem and of the conditions in order to determine which facts and principles are relevant and which are not. Second is that of developing informational or logical parameters which constitute the causal links between the conditions and the prediction and, in fact, make a rational prediction or explanation possible. For example, if one predicts that the presence of water in the desert will cause cities to be built, one needs also to make explicit the chain of causal links that leads from the availability of water to the building of cities. These chains may consist of logical conditions, such as that the presence of water is the only condition to make the soil productive, or from factual conditions, such as whether the desert soil contains salt or not.

These predictions and explanations are of different orders of generality and complexity: for example, the prediction that cities will be built as a consequence of a water supply represents a greater leap than does the prediction that grass will grow.

In order to develop criteria for effective teaching strategies it was necessary to evolve a theoretical construct. In the light of this construct these processes and their development were viewed.

Space permits the description of only a few principles in this theoretical construct. First, the learning of thinking was viewed as essentially an active transaction between the individual and his environment. The nature of this transaction is only partly controlled by the nature of the immediate stimulus. Partly, it is controlled by whatever mediation is available either in the form of models offered or of guidance that is available. Chiefly, however, the individual must develop for himself both the conceptual schemes and the processes of using them. In other words, the environment and training become available to the individual only to the extent that he performs certain operations on what he receives. These operations cannot be "given" in the ordinary sense of the word. An individual may, for example, imitate a model of the "if-then" reasoning. But this model remains unproductive unless he internalizes and elaborates this process himself.

Second, the development of thought follows a sequence in which the simpler and the more concrete operations must precede and prepare for the more complex and the abstract. The elementary school child, for example, must work out the idea of cause and consequence on concrete material before he can evolve an abstract concept of causes and consequences. It appears also that the elementary school years are the period during which the concrete thinking, or thinking with concrete objects and events, is being transformed into formal thinking or thinking with symbols. For this reason an emphasis on the development of certain basic cognitive skills on this level is crucial.

The idea of a sequential order applies also to the mastery of the skills involved in the cognitive tasks described above. As a matter of fact, the skills as described above could be seen as a series of sequential steps in which each preceding one is a prerequisite for the success in mastering the next one. For example, in interpreting data the differentiation of specific points is a prerequisite to comparing and contrasting these points or to seeing relationships between them. The latter is, in turn, a prerequisite for making inferences, and so on.

Finally, the conceptual schema undergo a constant reorganization. The dynamics of this reorganization can be visualized as a rotation of intake of information into the existing conceptual scheme and the extension or reorganization of the scheme whenever the problem or the information received creates a dissonance because it does not fit the scheme. For example, a child whose concept of relationship of altitude and temperature is that the higher one goes the colder it gets is jarred into modifying this concept when faced with the fact of high altitude combined with high temperature. He now needs to extend this concept to include the concept of geographic zones.

Piaget (11) calls these two processes "assimilation" and "accommodation," and these terms will be used in the discussion that follows. This rotation of assimilation and accommodation seems to describe the psychological dynamics or mechanism for the gradual maturation of thought, and, as such, is extremely important in the strategy of training.

Hunt (9) points out, in addition, that this rotation requires a proper match between the existing conceptual scheme and that which is required by the new information or task. When the requirements of the accommodation are too far beyond the existing conceptual scheme it is impossible for the child to make a leap. When it is too close there is no challenge for reorganization.

Teaching strategies for cognitive growth.

The concepts of the cognitive tasks together with the principles which govern the development of the cognitive skills have interesting implications for the formulation of teaching strategies.

First, the concept of thinking as essentially an active process, in the sense that it can be learned only by doing, sets the process of teaching into a new perspective. If students are to develop a cognitive structure by their own efforts, the usual role of teaching and of the teacher has to be reversed. Instead of teaching consisting primarily of communication of information, with the role of the teacher as a fount of that information, he needs to become an adroit guide of the heuristic process. In this kind of teaching strategy the art of asking questions assumes a crucial role. Questions, furthermore, need a double focus: on the substance of what is being discussed and on the cognitive operations. A question such as, "What materials do we use in building houses?" focuses on the materials and excludes other characteristics of building houses such as tools and labor. This question also asks for enumeration of these materials rather than explanations of why these materials are used. Other questions are addressed to explanation, such as why women in certain primitive tribes carry things on their heads or why some countries fail to use the natural resources they have.

The concept of sequence and of the rotation of assimilation and accommodation suggests, further, that teaching acts, such as the questions, need to be programmed to foster an appropriate sequence of learning. If the learning to apply knowledge to explaining new phenomena involves mastering certain modes of thinking in a certain order, then the questions the teacher asks and the remarks she makes need to follow that order. If there is to be rotation of intake of new information with tasks that require changing the conceptual structure, then the teaching acts need to be organized to stimulate such a rotation. If time and pacing of transitions from one mode or level of thinking into another is essential, then the teaching strategy must manage this pacing. In other words, teaching needs to be addressed first to the objective of thinking; second, seen as a series of acts, each of which has a specific pedagogical function; and, finally, viewed as a strategy or organization of these functions.

In the study described above, *Thinking in Elementary School Children* (16), two groups of teaching functions were identified which seemed to affect the development of cognitive skills, either positively or negatively. First are questions or statements made by the teacher or the students which are psychological or managerial in their function and unrelated to the logic of the content. Statements of this type included approval, disagreement, disapproval, management, and reiteration. Second, are teacher questions or statements which give direction to discussions and are related to the logic of the content and of the cognitive operations sought. This group of functions included focusing, refocusing, change of focus, deviating from focus, extending thought on the same level, lifting thought to a higher level, and controlling thought (16*).

Focusing questions or remarks establish both the content topic under consideration and the cognitive operations to be performed. They set the cognitive task. For example, a question by the teacher such as, "If the desert had all the water it needed what would happen to the desert way of life?" establishes the central content topic for discussion and calls for prediction of consequences. However, to prevent students from indulging in associative thinking which follows a single line and opens up new dimensions, a change of focus may be needed. Refocusing may be necessary to bring the discussion back to the original topic.

Extending thought on the same level fulfills the requirement of allowing a sufficient amount of assimilation before thought is lifted to another level, such as making a transition from description of specific points noted in a film, to explaining why certain events took place in the film or from prediction to establishing its validity. This is essentially a strategy in which a number of students are induced to respond to the same question instead of proceeding from an answer by one student to a question to the same one, as is usual. Extension of thought on the same level also assures the participation of the slower students. This engages them in the initial step of the process and thus prepares them for participation in the next step.

Lifting of the level of thought occurs when the teacher or child either gives or seeks information that shifts the thought to a level higher than the previously established one. Thus, making a transition from enumeration to grouping and from grouping to labeling represents lifting of thought. However, pursuing each of these steps by engaging more students or by seeking clarification and elaboration would represent extension.

Controlling thought occurs when the teacher gives what the students should do for themselves, such as suggesting a category or classification or giving explanations of phenomena observed instead of seeking explanation from the children.

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*Chapter 7.

The examples below illustrate the function of focusing, extending, and lifting thought:

(1) C Malobi took the money home with her. (Child gives specific information.)

(2) T What did Malobi do with the money? (Teacher seeks specific information.)

(3) C She saved it. (Child extends thought on the level of specific information.)

(4) C She put it underground. (Child extends thought on the level of specific information.)

(5) C She put sticks and tin over it. (Child extends thought on the level of specific information.)

(6) C Before she did that she put it in a little pot. (Child extends thought on the level of specific information.)

In the following example the teacher attempts to lift the level of thought from the giving of information to explanation:

(1) C They carried things in baskets on their heads. (Child gives specific information.)

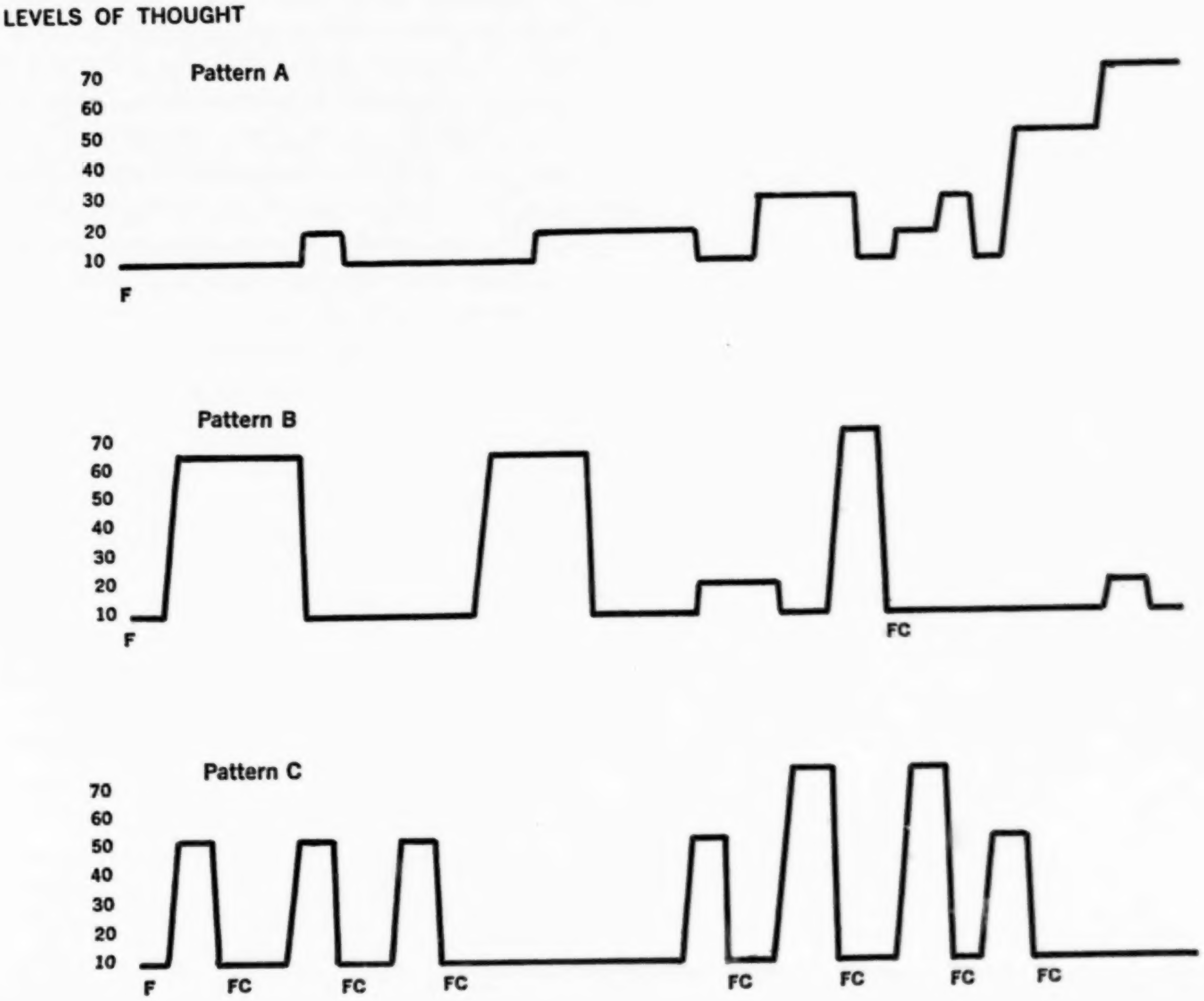
(2) T Explain why. (Teacher lifts thought to the level of explanation.)

(3) C I suppose they can carry more things that way. (Child gives an explanation.)

The combination of these functions together with the pacing of assimilation and the timing of lifting thought to a new level is what constitutes the teaching strategy. This strategy is determined by recognizing that it takes time to learn the skills involved in these cognitive tasks. They are not in the class of instantaneous learning. Furthermore, presumably there are individual differences in the speed with which these skills can be mastered. Some students may make a clear distinction after a few attempts at enumeration, while others need to "mess around" for a longer time to discover what is at stake and what the model of differentiation is. Teaching strategy, to be effective, must allow variation in pacing each step, determining how long to continue on the plateau of each step, and when to make a transition to the next one.

In order to assess the effectiveness of these pedagogical functions, the verbal remarks of students were rated as to level of thought in each of the three cognitive tasks. In effect, these ratings described the successive cognitive operations involved in each of the tasks described previously. Presumably the process of making inferences is a more complex one and of a higher order than is identification of the points in the information presented, the latter being a prerequisite to the former. In the task calling for inferring from data, a teacher may seek, first, specific information. She may then attempt to lift the level of thought to that of explanation, and follow with questions designed to elicit inference, *etc.* The success in eliciting appropriate responses constitutes the measure of the effectiveness of the teaching strategy.

The charting of this flow of teaching acts and of the level of students' responses describes visually the relationship of the two. For example, when the teacher attempts to raise the level of thought too early in the discussion, this typically results in the children's returning to a lower level and in their inability to sustain discussion at the higher levels of thought. On the other hand, an effective strategy of focusing, extending, and lifting thought, combined with appropriate pacing of extensions and properly matched lifts, will result in a gradual movement toward higher levels of mental operation by the majority of the students. A frequent change of focus produces an alternation between several levels, a lack of sustained thought at any level, and a gradual return to the most primitive one. The same result occurs when the teacher inserts controls of thought by giving students what they should be doing for themselves. The figure below illustrates some of these strategies:



Class Discussion Patterns

F—Focusing
FC—Change of Focus

Pattern A represents a strategy in which the transitions are paced appropriately, with the result that the class follows the transitions from one level of thought to the next and sustains the thought on each. In Pattern B the lifting of thought occurs too early, with the result that when the few students who could follow it have exhausted their ideas the class settles down to the lowest level. Pattern C illustrates a discussion in which the focus is lost, and the teacher is forced to keep the discussion alive by constantly changing the topic, without being able to sustain thought on any.

What, then, can be said about the merits of this approach to teaching thinking? First, the specification of thinking as an object of educational effort permits a clearer analysis of the appropriate pedagogical functions necessary to make this objective both more realistic and attainable. A more clearly focused target together with more articulated pedagogical functions may also permit a more effective training of teachers than is possible when both the nature of cognitive processes and of the appropriate teaching strategies for them are vague and obscure.

Second, it seems that a similar analysis of other educational objectives, such as the enhancement of the ego concept, the growth in affective domain, and the development of a creative approach to literature and art, might eventuate in the kinds of description of instructional processes which may provide the material for the development of a generic and a functional theory of learning and teaching.

Finally, such an approach to teaching thinking may reach students who are now relatively untouched by instruction. The results of the study described here indicated a lack of correlation between the performance on the test of Inference in Social Studies and the students' IQ. Analysis of tapescripts suggested that a careful structuring of the sequential steps in mastering the basic cognitive skills and an appropriate timing and pacing of the transitions from one level of thought to another are the chief ingredients to opening the possibility for a higher level of mental functioning to students of low ability (as measured by tests of intelligence). Analysis of a few individual cases indicated the possibility that among the so-called slow students are many who are only slow absorbers. Evidently, when the amount of information to be assimilated is reduced and opportunity is provided for systematic processing of that information, such students can function on abstract levels of thought.

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Harriett Amster

Concept Formation in Children

Diverse routes have been taken toward understanding how children form concepts and a multiplicity of methods have been utilized. The leading investigator of children's concepts, Jean Piaget, has described specific concepts employed by children and, from these, has inferred certain formal characteristics of their thinking processes. His approach is a generic one in which he attempts to distinguish and describe stages of thinking and to categorize the psychological functions within these stages. In contrast, the main emphasis of this paper is on how concepts are actually learned.

Many investigators have attempted to study how concepts are attained under standard conditions by studying what the child does in the course of attaining a new concept. Some of these investigators infer the psychological processes of the child from the concept he learns during the experiment while others study introspective reports as more direct reflections of the processes they employ. Researchers also vary greatly in their definitions of concept formation. Even among the investigators who have attempted to study the psychology of concept acquisition experimentally, there are vast differences in the types of materials employed and the nature of the behavior which is measured. I shall discuss three intriguing problems within the area and present some research which is for the most part, illustrative of the newer psychological approaches to concept formation in children.

Processes of Concept Learning in Children

There must be innumerable ways by which children and adults form concepts. However, two types of responses which seem basic to the many possible ways of forming concepts are associative processes and deductive processes. Associative processes are thought to be intuitive in that concepts are arrived at on the basis of both verbal and nonverbal associations to the presented exemplars. Despite the fact that the outcome of such association may seem to be intuitive, I think that the associations which "emerge" automatically have been formed through a basic type of rote learning. By contrast, the deductive processes are thought to involve logical reasoning and hypothesis testing on the basis of strategies. I think that these do not occur spontaneously without prior learning. Rather, they are learned and could also have been acquired originally through a basic form of rote learning. Processes related to these have been described by Woodworth (36) as alternative processes by which concepts may be formed, but it is likely that they can occur simultaneously and interact (23, 24, 32). More specifically, I hypothesized that the associative processes would be more universal than the deductive processes. Therefore, when adults form concepts without deliberately attempting to do so, the associative processes should be dominant, but when they make a deliberate

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attempt to form concepts, the deductive processes might be dominant. The evidence was consistent with the hypothesis.

I had expected that efficiency in concept formation would improve with the use of hypothesis testing, and that this would be demonstrated by greater efficiency of intentional concept formation than incidental concept formation among children old enough to use logical reasoning. In several experiments (1, 25) involving detection and recall of features common to a set of spatial forms, kindergarten children and fourth graders excelled under the intentional set. The trends of the means by no means confirmed the hypothesis that the intentional set should be more beneficial to the older children than to the younger children. These results strongly suggest that instructions are as important a factor among kindergarten children as they are among older ones, and, therefore intentional instructions should be used to increase learning in that age group. However, it does not necessarily follow that the kindergarten children are benefitted in the same way as the older children. This is illustrated indirectly by the fact that kindergarten children improved with practice under the intentional instructions to a greater degree than under incidental instructions, while in contrast, the older children showed greater improvement under the incidental instructions. Quite possibly the first test of concept recall alerted the older children to the need to engage in intentional learning while the younger children may have continued to respond on an incidental basis.

As pointed out by Vinacke (33), deductive processes of concept learning may become increasingly evident as children grow older. Various findings, including those of Piaget (22) and Inhelder and Piaget (9), are consistent with this concept of the emerging dominance of logical reasoning. Although his analyses involve processes of thinking much more specific than the two types we have described, the stages he distinguishes involve an increase in the use of mental operations with age. Moreover, the types of operations employed seem to change with age, culminating in the appearance of logical operations about age 11 to 14. Similarly, much of the vast literature surveying the types of concepts formed by children of varying ages is generaly consistent with this position. For example, Olver (19) studied how seemingly different objects are grouped into equivalence classes. In addition to studying the semantic bases of grouping, *e.g.*, the types of features which children use in classifying objects, she studied the syntactical structure of the equivalence sets. With respect to the former, she found, in agreement with other studies, that the tendency to categorize on a perceptual basis declined from age 6 to 9 while the tendency to categorize on the basis of function increased. With respect to the syntactical structure of the groups, she singled out three types of structures: *heaps* or arbitrary collections, described earlier by Vygotsky (34); *complexes* in which the various members are included in accordance with a rule that does not account uniformly for the inclusion of members in the set; and *superordinate* groups in which one rule accounts for all the objects in the set. Among the various types of complexes were those characterized by edge matching in which an object is included on the basis of some similarity with a neighboring member. For example, a six-year-old would say that a banana, peach, and potato are alike because banana and peach are yellow and peach and potato are round. Others involved assorted objects related by their relevance to a story or their relation to one object although the objects may not have been related to each other. As expected, the occurrence of superordinate groups increased from age 6 to 19 while a parallel decrease in complexive groupings occurred. Needless to say, the classification of objects into superordinate groups involved the ability to test hypotheses to determine whether each object is or is not a member of the set. Consequently, these results are consistent with the postulation of the increasing dominance and effectiveness of logical processes with age. This has been shown among adolescents who have been found to improve in efficiency of concept attainment and in the use of strategies. Yudin and Kates (37) found that 14- and 16-year-olds were not different from each other but were superior to 12-year-olds in this regard.

Teachers may be especially interested to learn that children of superior intelligence may attain concepts by testing hypotheses while children of average intelligence do so through more of a rote process. Osler and Trautman (21) have found corroborative evidence for this hypothesis. The ability of children aged 6, 10, and 14 to identify the concept *two* was studied. In one group the children were given pairs of stimuli of which one was two solid black circles and the other was 1, 3, 4, or 5 solid black circles. In the other group the pairs of stimuli again consisted of one card with two figures and another card with some number of figures other than two. However, in this case colored pictures of common objects were used, and different objects were used to represent the positive and negative instances within a pair. The crucial difference between the two sets of stimuli was believed to lie in the amount of information which was irrelevant to the concept *two*. Half the children were given the simple stimuli and the other half were given the more complex stimuli. It was expected that more hypotheses could be generated on the basis of the complex stimuli than on the basis of the simple ones; consequently, children who were testing hypotheses should do *more poorly* on the basis of the complex stimuli than those who were learning by a rote process. As expected, the highly intelligent children in all three age groups made more errors in achieving the concept from the complex instances than from the simple instances. The complex instances did not, however, slow down the average children; it slowed down the superior children who were undoubtedly testing diverse hypotheses to arrive at the concept. I believe that this experiment also supports the idea that the processes interact. Bright children must use associative processes as do average children, but they would have more different associations to any two stimuli than average children do. Therefore, the many interesting and varied associations interfere with the production of the simple association *two* which emerges more readily in the average child. Both processes could thus contribute to explaining the results. It is interesting to note that in this experiment, the use of hypothesis testing was found to be a relatively inefficient strategy in contrast to what we assume the usual case must be.

Dramatic confirmation of the role of intelligence in concept formation was obtained by Osler and Fivel (20) using a task similar to the above. Among children of superior intelligence there were more sudden learners than gradual learners while the reverse was true for children of average intelligence. This suggests that the brighter children use deductive reasoning in confirming the solution.

The Acquisition of Word Meanings

Words, meanings, and concepts may be considered aspects of verbal concepts which may be considered as separate when a teacher tries to communicate a new idea or when concept formation is analyzed by a researcher. The need for and a discussion of distinctions among these terms appear in an interesting paper by Carroll (6). In general, in learning a word the child must perceive the various instances of a given word as similar and eventually differentiate among the contexts in which a given sound or sound pattern is used. A concept, on the other hand, involves a response to the similarities among a series of experiences and to the range of variations in such instances. This response to the range of variations serves to permit differentiation among concepts.

A "meaning" can be thought of as a concept which is standardized by society and "when we say a word stands for or names a concept it is understood that we are speaking of concepts that are shared among the members of a speech community" (6). Psychologically speaking, the processes of acquisition of concepts and meanings must be identical. However, there may be considerable variation depending on whether the formation of a concept involves the learning of new responses to a set of experiences or merely regrouping concepts which have been learned in the past.

There are undoubtedly many ways by which words and concepts come to acquire meaning to the child or the adult. It is quite possible that during the early years, processes which are of prime importance require the physical presence of the referent or concrete examples of the concept and some manner of reinforcement contingent upon the response. This could take two forms (28), *i.e.*, when a child says "water," water is then brought, and as a consequence the child learns the meaning of *water*, and when a child is praised for saying *water* whenever he sees or experiences water. However, as the child's knowledge of the world increases, it is quite likely that he acquires the meaning of words and concepts from other words. For example, he may do so either from the presentation of synonyms or roughly equivalent words or verbal definitions. He is told that *joy* means *happiness* or is given a more formal definition in terms of genus and species. But between these two types of situations lies what may be the most widespread manner by which verbal meanings are acquired. It involves the acquisition of verbal concepts from their use in verbal contexts.

The influence of the verbal context on the way in which a meaningless word acquires connotative meaning has been extensively studied by Staats and Staats and their associates (29, 30, 31). When meaningless words are merely paired with meaningful words they acquire the connotation of the meaningful word in accordance with the expectation based on conditioning principles. These studies are outstanding in that they involve a finegrain analysis of the acquisition of meaning.

It is probably only with very young children that the acquisition of new concepts can be studied, although the extent to which a concept is new is undoubtedly a matter of degree. The acquisition of language and concepts has probably received more attention among Russian investigators than Americans in recent years. Kol'tsova (16) investigated the role of the breadth of experience with objects on the formation of concepts of them. The concept *doll* was investigated in one experiment. Two groups of children about 20 months of age were shown a doll 1,500 times in the course of several months. For one group the experimenter employed only three statements, "Here is a doll," "Take the doll," and "Give me the doll." For the other group he employed thirty different statements such as "Look for the doll," "Rock the doll," "Seat the doll," *etc.* The total amount of verbalization by the experimenter was the same for both groups, but the group for which the presentation of the doll was accompanied by the greater variety of verbalizations was superior in their learning of the concept, *doll*. This was shown by the ability of the children to select dolls from among other toys. On appropriate instruction the group receiving greater variety of verbalization restricted their selections to dolls whereas the other group did not. In a similar experiment using children of 19 months of age, two factors were varied: the number of different examples and the variety of verbalizations. There were three groups: in one group, one book was shown once with one verbalization; in a second group, twenty different books were shown with only one verbalization; in a third group, one book was shown with twenty verbalizations. The group with twenty different verbalizations was superior to the others, while the group with only one book and one verbalization learned the least about the meaning of *book*. They could not separate books from other objects and could not carry out commands using the word *book*.

Werner and Kaplan (35) attempted to study the course of acquisition of word meanings in children who ranged in age from 8½ to 13½ years. They devised an ingenious method, the Word Context Test, which involved the presentation of several series of sentences each containing an artificial word. For example, the following sentences were among those from which the concept *gather* was to be abstracted:

All the children will *lidber* at Mary's party.

The police did not allow the people to *lidber* on the street.

The people *lidbered* about the speaker when he finished his talk.

The children were asked to define the concept as each succeeding sentence was presented. The first sentence remained in view when the second was shown. The authors attempted to analyze developmentally the reported changes in verbal meaning and found many changes with age, *e.g.*, a striking drop in the occurrence of concepts which consist of parts of a sentence (sentence-contextual concepts) at about 10½ years. They believe that word meaning is derived from the verbal context and describe many processes by which this occurs. The most important among these is decontextualization, a process of acquisition involving a gradual refinement in meaning in which the specific features of the contexts are dropped, until all that remains are the features of meaning which characterize the word in all contexts. However, this final stage of decontextualized meaning is only to be found in relatively mature individuals. Bruner (3) analyzed the process of acquisition in this situation in a different way. He claims that the solution to each series of sentences is the word that has the highest probability across the series. This suggests that there is some associative process whereby the context probability of the new word increases from sentence to sentence. I think there is also a strong possibility that acquisition is a two-stage process involving not only association, but also deductive reasoning about whether the associations to the sentences "fit" the context.

It seems quite reasonable to assume that the formation of verbal concepts must often be unintentional and that unintentional concept formation should be largely associative. As mentioned in the discussion of the research by Osler and Trautman (21) above, consideration of concept formation under a large as compared with a small variety of instances suggests that the large variety should, in the case where many hypotheses are desirable, make for superior concept learning for both associative and deductive processes. However, the difference in effectiveness between a large and a small variety of instances should be greater for children employing both processes, *i.e.*, older children. A small variety might be more effective if memory for the instances or attention to the task is a problem. Thus, it would be expected that a large variety should be clearly more effective than a small variety for older children who would use both deductive and associative processes, but that the superiority should be less clear for the child who does not employ logical reasoning and/or the more distractible child who may tend to be younger or less capable.

A child may not employ logical reasoning either because he has not yet acquired the tendency or ability to do so effectively or because he is forming concepts unintentionally. In one study (25) I compared the number of concepts correctly elicited on the basis of a large variety and a small variety of different sentences. A large variety was usually six different sentences and a small variety was either three or two different sentences repeated twice or three times, respectively. A general superiority of a large variety of sentences over a small variety would be expected on the basis of the theory that concept elicitation is a matter of association. The more sentences which are added, the greater the probability that one of the sentences will elicit the concept and the greater the probability that the set of sentences will do so. When logical reasoning is used, children should be checking to see whether hypothesized concepts "fit" the sentences. Increasing the number of different sentences increases the occasions on which a hypothesized concept might be rejected and, therefore, on this basis a large variety should be more efficient than a small variety. In general, children about six years old and about eleven years old tended to form more correct concepts on the basis of the larger variety of contexts and to apply them more appropriately in a new situation. However, as anticipated, there was a reverse trend among two groups: older children who were forming concepts incidentally and older children who were relatively inefficient at the task. I believe both processes are employed by older children who form concepts intentionally, but when they do so unintentionally, the associative process is dominant.

On the basis of our limited evidence, it seems possible that the associative process is primary not only among young children, but also among older children who have limited memory or attention span and among younger children.

In a new study, I am investigating further the process by which the concept is acquired. Fourth graders were each given only one sentence corresponding to each concept. The same sentences and concepts were used which had been used in some of the experiments mentioned above. No statistically reliable difference was found between the frequency with which the concept was given in response to the "best" sentence of the set and the frequency with which it was given in response to the sets of 2, 3, or 6 sentences. Certainly one would expect it to be better in response to the group of sentences than to any single sentence if there is some kind of summation of associations across the series. Further evidence of absence of summation was obtained by comparing the response to the group of sentences with the expected response which would be predicted on the basis of the responses to the individual sentences. It was found that the expected response to the group of 3 or 6 sentences was significantly greater than the obtained response to the group. However, it can at least be said that the occurrence of the correct response to the group is strikingly greater than the occurrence of this response to the average single sentence that comprises it.

The Role of Verbalization in the Acquisition of Concepts

Russian psychologists (17, 18) have pioneered in the investigation of the role of language in the regulation and control of behavior. These investigators have postulated and also found increasing linguistic control of behavior with age. American studies on the role of verbal mediation generally suggest that the critical age for the occurrence of mediation may be different for different situations (27). Among the foremost American investigators of the role of semantic mediation in children's conceptual learning are the Kendlers who have intensively studied reversal shift behavior. In a simple version of their procedure, the nursery school child is shown a large black (white) square and a small black (white) square for the initial discrimination task. He is rewarded every time he selects the small square, regardless of whether it is on the left or the right. After they have learned to select the small square consistently, the children are given a similar task in which the objects differ in two dimensions. Some are then rewarded for shifting their choice to the other object, some are rewarded for learning to respond to a cue from the new dimension, and for comparison purposes, some continue to be rewarded for the same choice as before. Other reversal shift procedures involve presentation of pairs of objects which differ in only two dimensions for the initial discrimination learning task. For the second task, the pair may differ in only one dimension. This task measures the ability to shift to the opposite value of the initial dimension and also the ability to learn to respond to a value of the newly varied dimension. The ability to shift is believed to involve the same mediated response as the initial task although the overt response is changed. The new response requires a new mediated response as well as a new overt response. Consequently, if mediation is employed, the reversal shift should be learned faster than the new response. Several studies support this hypothesis. The reversal shift behavior of college students (12) supported the hypothesis being in direct contrast to that of rats (11). For kindergarten children as a whole, no difference between reversal shift and new learning was found, but when the group was divided into fast and slow learners a dramatic difference appeared (13). The fast learners acted like college students and the slow learners tended to act like the rats. It was expected that nursery school children would resemble the slow learning children of kindergarten age, but that requiring them to verbalize might enable them to behave in a more mature fashion. However, compared with an uninstructed group, instructing the children to verbalize both the right and the wrong value of the dimension during the initial task did not improve their ability to shift (15). In another experiment one-third of the nursery school children were instructed to verbalize the right value, *e.g.*, black when black was rewarded, one-third were instructed to verbalize the wrong value, *e.g.*, black when white was rewarded, and one-third were not instructed to verbalize. In this case, verbalization of the right value of the dimension did facilitate the ability of nursery school children to shift and it also facilitated this ability in second graders (14). For children of both ages, irrelevant verbalizations retarded the ability to shift. There was also a trend for the relevant verbalizations to be more beneficial than no verbalization for the younger group, but for the older children there was no difference. This suggests that the seven-year-olds spontaneously used verbal mediation and were, therefore, not additionally assisted by the instruction to do so.

Despite the strong evidence for the increasing use of verbal mediation with age, there is a curious fact which runs through much of the literature on children's learning. It has been noted in a wide variety of investigations and also among children of varying ages (4, 8, 15, 18) that the spontaneous verbalizations of children do not necessarily or even consistently correspond to the behavior which they exhibit. For example, the Kendlers (15) mention that some nursery school children name the correct value but continue to make the wrong choice for many trials. The kinds of correspondence between language and performance require a good deal more investigation before this puzzle can be illuminated further, and some of this work is now going on in Russian laboratories and at Harvard by Bruner and his associates.

Despite the fact that subjects in concept formation experiments can often learn to classify objects correctly without being able to define the class, giving an instruction to verbalize distinguishing characteristics of the class has been found to benefit 11- to 13-year-old children (10). In this experiment one group was asked to classify colored pictures of birds into gunkle birds and bunkle birds. They were then asked to define the concepts. The other group performed the same task, but during the classification task they were asked to guess how to tell a gunkle bird from a bunkle bird. Although no evaluation of the answer was given by the experimenter, there were almost twice as many good definitions given in this group. Although it is impossible to tell whether the instructions to notice similarities and differences or the necessity to verbalize them produced the facilitation, the results certainly suggest that older children can benefit from such instructions.

Using a task in which children between 5 and 7 years of age were to arrange nine plastic glasses in a 3 x 3 matrix, Bruner and Kenney (5) studied the linguistic descriptions of children's behavior. The glasses varied in diameter and height, and were initially shown to the children, correctly ordered in the matrix. The children were acquainted with the matrix and asked how the glasses in the columns and rows are alike and how they differ. Following this, the glasses were scrambled and the child was asked to reproduce the matrix. Finally, a transposed situation is presented. The shortest, thinnest glass is placed in a different corner from the original and the child is asked to make a matrix, leaving this glass in the new position. Almost all the children succeed in the matrix-matching although, as expected, the older children perform more quickly. On the other hand, most seven year olds succeeded in the transposition test while hardly any of the younger children did. However, the most interesting analysis concerned the relationship between the type of verbal description made by the children and their ability to perform the transposition test. There were three types of verbalizations: *Dimensional* in which the child distinguished both semantically by naming both ends of each scale, *e.g.*, "that one is higher and that one is shorter; *Global* in which the language did not refer specifically to one dimension, *e.g.*, "that one is bigger and that one is little"; *Confounded* in which a dimensional term would be used for one end of a continuum and a global term for the other, *e.g.*, "that one is tall and that one is little." Interestingly enough, the children who used the confounded descriptions were far more likely to fail on the transposition task than either of the others. Also, the investigators were unable to find a relationship between the language the children used and their ability to perform the simple task of reproducing the matrix.

The widespread occurrence of this lack

of direct correspondence between language and action certainly compels us to conclude that although language assumes an increasingly important role in the processes of concept acquisition, one cannot assume that thought and action are directly correlated or that the relationship between them is a simple one.

There is an additional body of experimental literature on the role of verbalization in the acquisition of concepts which deals with the relative efficacy of various types of verbalization about objects on the ability to manipulate those objects as exemplars for the formation of a concept. In a study by Dietze (7) four- and five-year-old children learned names for similar-appearing spatial forms. One group learned similar-sounding names and the other group learned different-sounding names, and those who learned the different-sounding names excelled on all measures of concept formation employing the spatial forms. Rasmussen and Archer (26) found that compared with making aesthetic judgments, merely learning nonsense names for objects did not aid college students in using the objects to form concepts in a later situation. The group which made artistic judgments about these objects must have noted and verbalized more similarities and differences among the objects than the group which merely learned names for the objects. Therefore, in the subsequent situation, those who had made the aesthetic judgments excelled over those who learned the name. With some procedural modifications, this experiment was repeated on eleven-year-old children with basically the same result (2). The crucial question must be not whether verbalization is employed, but to what and how the verbalization applies. It surely demonstrates the relevance of the type of verbal label to the ability to form concepts on the basis of the labelled objects.

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MURRAY S. MIRON

The Quality of Qualification

A natural language such as English is the result of a series of historic accidents. Such languages contrast sharply with contrived languages such as mathematics, computer instructions (Fortran, Algo 60), or Esperanto in that the ecological processes of selective survival of the former are either truncated or completely absent in the latter. It is the fact that the language is living which is important, despite the circumstances that its breath often may mist the mirror reflecting the essence of wisdom. The outcome of the struggle to be understood by lazy people, while still adequately characterizing what impresses our senses and what doesn't, is distilled and ongoing in the present state of the language, even in the noises we make with our eating apparatus merely to show sentience. Thus we may study natural languages for clues as to the psycholinguistic characteristics of the people who speak them.

Such has been the goal of the group of researchers at the University of Illinois Institute of Communication Research. Our main attack on the psychological functions of language has been through the use of an instrument called the semantic differential. This instrument, developed by Charles Osgood (6, 8), uses the affective or connotative terms of a language to characterize the meaningful differences among the concepts employed by language users. Every language has developed some means or other of specifying the intensity and quality of the experiences impinging upon our human senses and, by metaphorical extension, the intensity and quality of those concepts not open to sensory confirmation. In English such qualification is largely controlled by the class of words ordinarily called adjectives. The semantic differential technique asks subjects to rate the degree to which they feel that the concepts to be differentiated are characterized by an efficiently small set of contrastive adjectival attributes.

Form of the Task

A typical administration form of the semantic differential would contain anywhere from 10 to 70 adjectives with their opposites, separated by seven step divisions, *e.g.*,

Father

good__:__:__:__:__:__:__bad

strong__:__:__:__:__:__:__weak

The subjects are instructed to indicate with a check mark the degree to which they feel that the adjectival "scale" is expressive of the concept displayed at the top of the list of these scales. The closer the check mark is placed to either one side or the other of the contrastive attributes expressed by the scale, the more extreme the relatedness. Subjects are instructed to proceed rapidly through each of the scale items, judging for each the degree of relatedness of the attributes for the same concept term. After a short practice period, a subject typically can be expected to complete from 20 to 30 such judgments in one minute's time.

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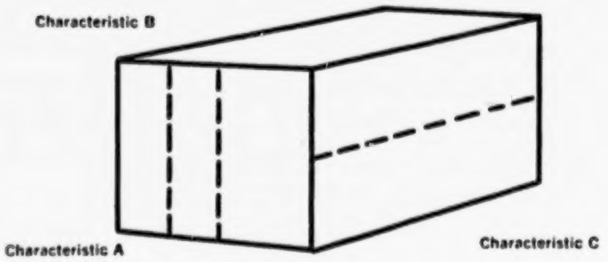
Theory and Standardization of the Technique

It should be obvious that the degree of precision of the characterization of a concept in terms of adjectival attributes should be dependent on the choice of the particular scale and concept items chosen. More generally, the hope that such a technique could be at all useful is dependent upon the demonstration of a stable and parsimonious structure in the ways in which natural languages organize the domain of attribute terms.

Although it is theoretically possible to enumerate all of the qualifiers in any natural language, in practice their number is too large to make such enumeration practicable. Thus, although we might theoretically hope to find optimal discrimination among concept terms by having subjects rate their degree of relatedness with every adjective, such a technique would hardly be parsimonious. Even granting that we can achieve near optimal discrimination among concepts with something less than the total list of adjectives, it is still possible that the meanings of these adjectives change so drastically when used as attribute terms for different concepts that no discrimination would be possible. Hence the requirement that the natural language must have a stable structure of attribute terms.

The hope of the discovery of such a structure in natural languages is not as optimistic as might appear to be the case for anyone sensitive to the nuances of qualification language makes available to its speakers. We are all well aware that colors can come in a bewildering variety of shades; the non-artists might not be aware, however, that all of these colors may be exactly characterized by reference to only three fundamental attributes: hue, saturation, and brightness. Assuming 50 degrees of variation in each of these three dimensions, their combinations would produce in excess of 100,000 different colors. Alternatively, we all know that cardboard boxes are manufactured in a variety of shapes; yet, if we wish to order a particular box from New Jersey or California, we need only specify the three dimensions of height, width, and depth in order to pick that one box, from the many, which we desire.[1]

Fortunately, there is a statistical technique which can be employed to discover the dimensional structure of a content domain for which the structure is unknown. This technique is known as factor analysis. From the patterns of the intercorrelations between a finite but large number of characteristics of the domain of interest, we infer the existence of a basic set of dimensions whose combinations could give rise to all of the observed variations. For example, on intuitive grounds alone, it is easy to see that if two characteristics of the items of a content domain always yield the same quantity, as would be the case for the measurement of characteristics A and B of the diagram, we may safely discard one of the characteristics as irrelevant



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[1] Note that we assume that we will be unconcerned about thickness of cardboard, finish, *etc.* We assume that volume or color is the characteristic which is essential to our decision. We shall return to the problem of ignored characteristics later in the paper.

to the unique specification of the domain.[2] If, however, we were to observe a characteristic which never gave us any knowledge of any other characteristic, if the characteristic never systematically varied with any other characteristic, as the C characteristic of the diagram theoretically behaves, it should be equally clear that such a characteristic supplies us with valuable new information in the specification of the content items.

The Content Domain of Adjectives

In many respects, the adjectives of English behave like colors. The combination of an adjective and its opposite has the effect of canceling the import of the terms taken separately, just as the additive mixture of complementary hues produces neutral gray. We may identify adjective opposites by the fact that they are mutually substitutable in utterances. For every statement which contains one of a pair of adjectival terms there is at least a theoretically apposite utterance which may contain its opposite. For every strong man, building, drink, and point, a weak counterpart is made available by the language. Not so with a pair like *good* and *puce*, as can readily be seen by the semantic anomalies which result when these two terms are substituted as qualifications of the above list.

Although it might be argued that colors exist in continuously variable gradations and adjectives are finite in number, the limitations of our visual apparatus limit the lexicon of colors far more than is the theoretical limit placed upon the number of qualifiers a language may contain. Nonetheless, it still may be the case that a small number of basic dimensional attributes of these adjectives can serve to specify their multitudinous diversity, just as we saw to be the case with colors.

Let us assume an *n* dimensional meaning space built on the analogy of the three dimensional color space. Each adjective of the language specifies some specific locus of the possible variations in meaning encompassed by the entire space, just as each color specifies a particular variation of the chromatic visual stimulus. The closer two adjectives lie within this space, the more nearly similar their meanings. Just as *red* and *orange* would be expected to lie closer in the color space than *red* and *blue*, so we should expect that *good* and *nice* would be in closer proximity than *good* and *heavy*. But how are we to systematize our intuitions about such meaningful similarities? The answer is deceptively simple. We enquire of the speakers of the language whether or not they would judge a large set of concepts to be appropriately qualified by the same set of adjective terms. If many speakers agree that *mothers* may appropriately be said to be *good, nice,* and *gentle* and that football players (by some, *e.g.*, high school coeds) are said to be *good, nice,* and *rough,* we are well on the way to a specification of the fact that the language exhibits more similarity between *good* and *nice* than between each of these terms and *gentle.* If we extend this approach to a large list of noun concepts and adjectives and allow gradations of degree of qualification such as *extremely* good, *slightly* nice, we have what has been called the semantic differential technique. The degree to which subjects choose and rate the same adjective terms as appropriate to the list of concepts establishes the degree of intercorrelation between those terms in the language the subject employs.[3]

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[2] The technique does not give us any clue as to which characteristic should be discarded. Much of the misunderstanding about factor analysis stems from the belief that we will retain the "true" characteristic. That we would somehow maintain A of the diagram rather than B. The hope is unwarranted.

[3] I have called such intercorrelations indices of distributional synonymy for want of a better term.

The Dimensional Structure of Adjectives

In a number of independent replications of these procedures we have consistently found that the adjectives of English exhibit a stable and relatively simple structure of essentially three dimensions. The first and most important of these dimensions is what we have called *evaluation.* This dimension represents those qualification terms which have reference to the worth or value of concepts and is best represented by such adjective pairs as *good-bad, nice-awful, happy-sad,* and *pleasant-unpleasant.* The second dimension we have named *potency* and is best characterized by such terms as *strong-weak, big-little, powerful-powerless* and *heavy-light.* The third dimension is *activity,* represented by such terms as *fast-slow, active-passive,* and *noisy-quiet.* In our studies these three dimensions taken together account for approximately 50% of all the meaningful variation in the semantic space encompassing numerous large samples of the qualifiers of English. Other and different dimensions do exist, but their contribution to the total variation in meaning becomes progressively smaller and more specific.

The earlier confirmation of this structure for English encouraged the group of investigators at the University of Illinois to attempt to extend the generality of our findings to all natural languages. In the summer of 1963 we established the Center for Comparative Psycholinguistics under grants from the National Science Foundation and the Institutes of Mental Health. With the help of some 40 social scientists in 20 countries around the world we began to collect semantic differential data in 16 different languages.

To avoid the potential bias of translation, and resultant ethnocentric bias, the procedures for selecting qualifiers that would eventually serve as the dimensions of judgment in semantic differential tasks had to be entirely intracultural; each language/culture group must determine its own descriptive scales. However, the overall methodology of these intraculturally independent samplings had to be standardized in order to make possible the intercultural comparisons required for testing the primary hypothesis of structural equivalence. Additionally, it was clear that testing the limits of generality demanded as heterogeneous a sample of both languages and cultures as could be obtained practicably. Our solutions to these requirements were to employ a standard word association methodology in each of a wide range of selected languages. Native speakers of each language are asked to provide qualification associates for a standard list of translation equivalent noun concepts. These elicited qualifiers represent the pool of items from which we draw the descriptive scales assumptively representing the intrinsic qualification dimensions in each language. By having recourse to the actual speakers of the language in order to derive our qualifiers, we may claim that the kinds of qualifiers obtained are being determined solely by those attributes considered important by the native speakers and not some outside agent.

Using an appropriately diverse set of stimulus terms, we obtain 10,000 qualifier responses in each language. From these items we wish to select a small number of representative qualifiers displaying the following characteristics: (1) The qualifiers must have high overall frequency of usage, (2) the qualifiers must display high diversity of usage, *i.e.,* the qualifiers must be applicable to a broad range of substantive contexts, and (3) the qualifiers must exhibit relative independence of usage, *i.e.,* they must represent uncorrelated attributes of the substantive concepts.

Indices of these requirements are computed from the responses obtained from the subjects. All responses are ordered by frequency of occurrence to satisfy requirement one: the number of noun stimuli giving rise to a particular adjective response is counted in order to satisfy requirement two. Both tabulations are then combined into a single index known as the information statistic H. This statistic gives highest weight to those responses which have both a high frequency of occurrence and a large diversity of eliciting stimuli. The third requirement is indexed by the intercorrelations between the patterns of distribution of the responses to the stimulus items. Responses occurring to the same stimuli are said to be distributionally synonymous, and if of lower H value are discarded from the list.

The remarkable thing is that even at this stage, similarities in the H ordering of the adjectival responses are clearly evident across all of the languages. Translation equivalent qualifier types are found occupying the same H ranks in the various languages well beyond any chance expectations. As to the structure of these qualifiers, we have been able to identify in every instance the existence of the three dimensions of *evaluation*, *potency*, and *activity* in that general order of prominence.

The Qualification Structure of Children

The fact that the basic structure of qualification can be characterized as an explicit dimensional system which transcends language differences suggests that we are dealing with an attribute which is primitively human. In fact, we have found that the qualifications used by children display precisely the same dimensional structure as that found for adults. DiVesta (1), employing the same procedures used in our cross-linguistic investigations, has tested children in grades 2 through 6 and found essentially identical factors even in the youngest children. Other studies, notably one by Ware (9), have shown that the structure is not modified when subjects of divergent intelligence are employed. In a sense, none of this is surprising; children, and even the very dull, differ from the lower organisms in the one crucial regard that they speak the language.

Interpretive Summary

The object of concern in these studies has been *homo loquens*. Man is the only talking animal. He has been taught to talk by other talking men in an historical regress that extends back in time to our earliest inferences about man. Being a characteristic of the human species, one should expect to find massive similarities transcending language boundaries; yet the obvious differences between languages have tended to obscure the more subtle, but more fundamental, similarities from the view of language scientists and scholars.

The researches reported here have led from the standard American college sophomore, to Americans differing in age, sex, and other characteristics, and even to peoples differing widely in both the structure of their language and the nature of their cultures. Nevertheless, the modes of qualifying used by these people are structured in the same fashion with remarkable regularity.

We are left with the question of why the dimensions of primitive affect should be *evaluation*, *potency*, and *activity*. The organism's earliest, most persistent and most significant interactions with its environment can be characterized as varying between the dichotomous states of physiological satisfaction and dissatisfaction. In the earliest stages, these states are induced directly by the properties of the *stimuli* encountered, but later they become associated with *signs* of such originally adequate stimuli. Still later, and most significantly for man, these states come under the control of social signs produced by others, particularly linguistic signs. In addition to this satisfaction-dissatisfaction dichotomy (which we may identify with the *evaluative* dimension), stimuli, and therefore their signs, can vary in at least two other regards: the amount of work or effort they demand from the organism (*potency* dimension), and the degree to which they arouse the organism (*activity* dimension).

Constructed as we are as human organisms, we have affective reaction systems designed to respond grossly in a limited number of ways, but to a very wide range of stimuli. These reactions by no means exhaust the ways in which we are capable of finely representing the minute distinctions in our environment, but they are now and always have been fundamental for survival. While the dimensions of affective meaning appear to be innate and hence are common to all humans, the way in which humans will react to particular signs depends upon learning. Thus, the particular meaning of particular signs will differ from one organism to another; but the dimensions which can specify the location of this meaning in the semantic space of the organism will be common to all organisms. With some clues as to what these dimensions may be, we can proceed to study these differences in meaning for different individuals with a common metric.

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JAMES J. GALLAGHER

Expressive Thought by Gifted Children in the Classroom

For many years there has been an unfortunate gulf between those professions whose purposes are to create or teach expressive thought, and phychologists whose goals are to attempt to understand more about man's thinking processes and developing intelligence. The psychologist has been fascinated with how a person can internally process information in such a way as to generate a product different from the information received. This interest in productive thought and the more specific subject area of creative thinking, has waxed and waned over the past few decades but now seems to be enjoying an important revival.

A review of the research in this area (Stein and Heinze, 1960) has presented a fine picture of the two main avenues of approach to studying this problem, investigating the creative thinker and investigating the creative process. While the study of the creative person has resulted in many interesting hypotheses, it is also fraught with difficulty. Many of the great creative geniuses that we would wish to study have long since passed from the scene and biographers often tell us more about themselves than about their subjects. It is also difficult to weigh the life of a Wilde against the standards of modern society, or to try and determine whether Wagner's financial irresponsibility was an essential or irrelevant part of the total creative person.

Recent work by MacKinnon (8) and by Barron (1) in their studies of creative *vs.* noncreative persons have suggested that there are certain personality characteristics that seem closely related to the creative person. Those judged most creative deviated more from the norm on measures of maladjustment but also possessed more ego strength than the less creative. They have an openness to experience and intellectual risk taking that permits them to take the atypical view.

The educator cannot be satisfied merely with dealing with the once-in-a-lifetime student who is destined to place his mark on history or to create enduring literature. His duty is a broader one which entails increasing the productive potential in all students.

Many investigators felt the key to improvement of thinking abilities was the study of the process by which the individual generates new thoughts. In order to determine what factors might influence student productivity or non-productivity in thought expression, one particular focus of this research interest has been the classroom environment. To study such a wide range of expressiveness as occurs in this special environment, one needs a method of cataloguing the classroom content and a theory of thinking ability that can aid in interpretation of the scene.

In this study, the theoretical model of Guilford (5, 6) was used as a basis for analyzing the expressive behavior. Guil-

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ford's structure of intellect was developed through a decade of research studies using factor analytic methodology. The parameters of this theoretical structure consist in the operations of thinking, the content within which these operations are performed, and the products which result from the performance of these operations upon the content.

Other investigators with similar approaches but different theoretical models are Smith and Meux (11); Flanders (3); Taba, Levine and Elzey (12); Medley and Mitzel (7); and Bloom (2), to mention only a few.

The purposes of the present study were to describe the kinds of thinking operations taking place in this variety of classrooms and to determine factors or variables that seemed to have influence on the expressive abilities of gifted students.

Subjects

The subjects in the present study were 118 boys and 117 girls, in junior and senior high school, placed in ten classes for gifted students. Each student was chosen for membership in these class groups on the basis of IQ scores and proven academic attainment. The mean verbal IQ was 131 for boys and 130 for girls; the mean nonverbal IQ score was 131 for the boys and 128 for the girls. Since group IQ scores were used in this instance and these scores often are found to be lower on group than individual tests, it was assumed that the groups chosen here represented at least the top five percent of their age group on this dimension. Gifted children were chosen for particular study due to their propensity to express themselves in the classroom setting.

Classification System

The present category system was constructed primarily on the operations of intellect as Guilford has described them. Five primary categories have been developed. These are: cognitive memory (C-M), convergent thinking (CT), divergent thinking (DT), evaluative thinking (ET), and routine (R). The routine category consists of the familiar and conventional interpersonal maneuverings of speakers in the management activities of the classroom setting, and in a number of categories defining behaviors—verbal and otherwise—expressing affect and feeling tone. In order that the reader have some idea of the dimensions of each of these areas of cognitive behavior in the classroom, a brief description is given below:

Cognitive-memory operations represent the simple reproduction of facts, formulae, or other items of remembered content through use of such processes as recognition, rote memory, and selective recall. Examples of cognitive-memory performance can be seen in the following:

T:	What were some of the main points covered in our discussion about mercantilism?
Mary:	One of the things we learned was that there was an attempt to keep a favorable balance of trade.
T:	What is a conjunction?

The above examples of teacher-student interchanges do not require the student to integrate or associate facts; the questions can be handled by direct reference to the memory bank. The sole duty of the student is to select the appropriate response from his store of remembered items. While factual information is clearly indispensable to the development of higher thought processes, it is also obvious that it would be a sterile and uninteresting class that dealt exclusively with this type of question, never moving into the challenge and excitement of more complex operations.

Convergent thinking represents the analysis and integration of given or remembered data. It leads to one expected end-

result or answer because of the tightly structured framework through which the individual must respond. Examples of convergent thinking are as follows:

T: If I were going to town A 170 miles away and drove at 50 miles an hour, how long would it take me to get there?

Bob: Three hours and twenty-four minutes.

T: Can you sum up in one sentence what you think was the main idea in Paton's novel, *Cry the Beloved Country*?

Pete: That the problem of the blacks and the whites in Africa can only be solved by brotherly love; there is no other way.

Thus, convergent thinking may be involved in the solving of a problem, in the summarizing of a body of material, or in the establishment of a logical sequence of ideas or premises—as, for example, in reporting the way in which a machine works, or in describing the sequence of steps by which the passage of a bill through Congress is accomplished.

Divergent thinking represents intellectual operations wherein the individual is free to generate independently his own data within a data-poor situation, or to take a new direction or perspective on a given topic. Examples of divergent thinking are:

T: Suppose Spain had not been defeated when the Armada was destroyed in 1588, but that instead, Spain had conquered England. What would the world be like today if that had happened?

Sam: Well, we would all be speaking Spanish.

Peg: We might have fought a revolutionary war against Spain instead of England.

Tom: We might have a state religion in this country.

These examples represent teacher-stimulated divergent thinking, but it need not always be teacher-generated. In a regular discussion of the "spoils system," a student may come up with the following:

Well, sure, the spoils system might be a good thing when a political party is getting started, but what about when there's no party system—like in the United Nations?

Here the student reveals his ability to take off from an established fact or facts and see further implications or unique associations that have not been requested or perhaps even thought of by the teacher. Instances of this type of self-initiated student behavior would also fall under the general category of divergent thinking.

Evaluative thinking deals with matters of judgment, value, and choice, and is characterized by its judgmental quality. For example:

T: What do you think of Captain Ahab as a heroic figure in Moby Dick?

Bob: Well, he sure was brave, but I think he was kind of mean the way he drove the men just because he had this crazy notion of getting back at Moby Dick.

T: Is it likely that we will have a hard winter?

Mary: Well, I think that the pattern of high pressure area suggests that we will.

T: Who was the stronger President, Jackson or Adams?

Mike: Adams.

In the first of the above examples, the student is asked to construct a value dimension of his own in terms of what he considers "heroic," and then to make a judgment as to where on this value dimension he would place Captain Ahab. In the second response, the student is asked to make an estimate or to give a speculative opinion or assessment of probability. A third possibility involves entering a qualification or disagreement, wherein the respondent would offer a modification of a prior judgment of another student; or he may state a counter-judgment, in which he declares direct opposition to the statement of the previous speaker.

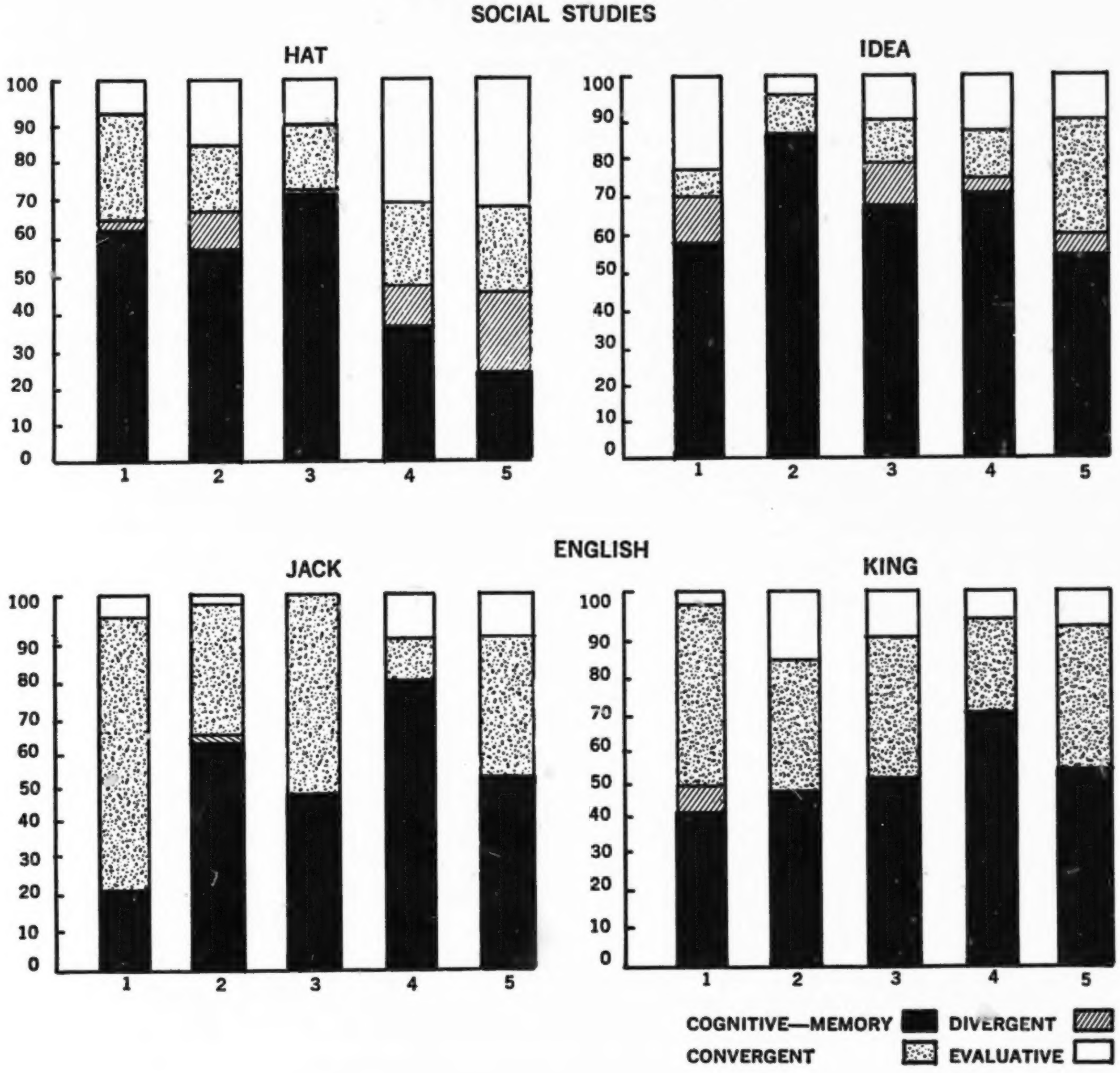
The final category, Routine, contains a large number of miscellaneous classroom activities. Included here are the attitudinal dimensions of praise and censure of others and of self. Also present are dimensions of *structuring*, a kind of prefatory remark, telling in advance what the speaker intends to say or do, or what he expects someone else to say or do. Other characteristic occurrences, such as humor, as well as the ordinary "routine" classroom management behaviors—even to requests to close the door or asking what time it is—are included in this primary category.

Procedure

Each of the ten classes were tape recorded for five consecutive hour sessions (two classes were taped in the fall and again in the spring to check on classroom consistency). In addition to the tape recordings, two observers were present in the classroom and took extensive notes on

Figure 1

PROPORTION OF THOUGHT PROCESSES
ASKED FOR BY THE TEACHER



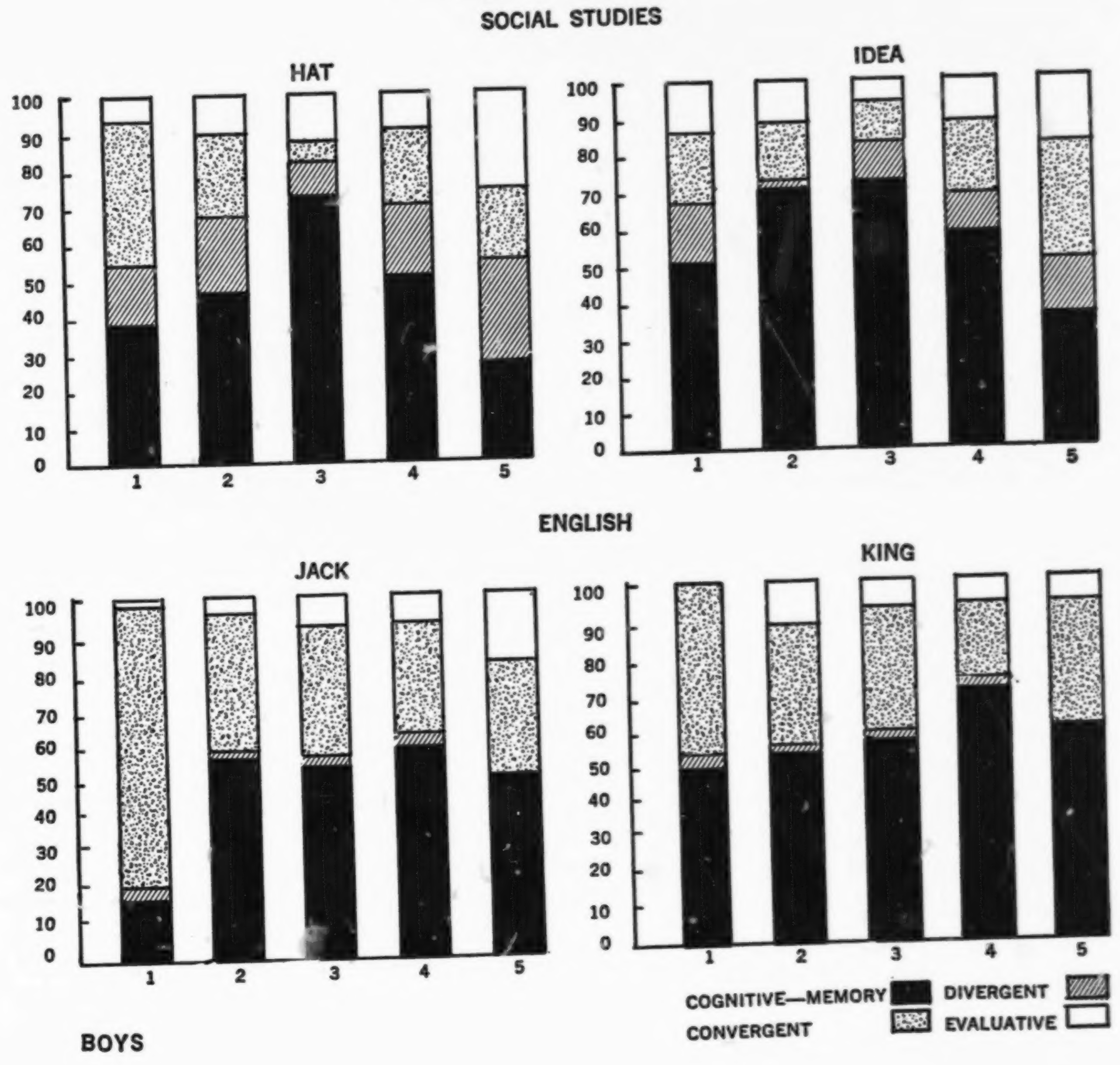
classroom activities such as demonstration, charts, blackboard material, *etc.* In addition, they noted the more obvious attitudinal relationships in the classroom such as censure, praise, frustration, humor, *etc.* Each transcribed classroom session was classified statement by statement by trained judges working with the scoring manual described above. The results of this analysis were then compared with test findings and teacher ratings on the dimensions of cognition (IQ tests and tests of divergent thinking), attitude (a semantic differential scale and sentence completion test), and sociability (teacher ratings).

Results

Figures 1 and 2 indicate the proportions of each major thought operation produced by teacher and by the boys in class over

Figure 2

PROPORTION OF THOUGHT PROCESSES GIVEN BY STUDENTS



five consecutive class sessions in two sections of social studies and two sections of English. Figure 2 represents only the boys' responses since the pattern of the responses were the same for the two sexes, although the total output was often different.

It will be noted that the majority of both teacher questions and student responses fell in the Cognitive-Memory area. There would seem to be an inescapable baseline of factual and memorized material that forms the basis of any classroom discussion. The more the class tends to a lecture type of operation, as opposed to discussion, the more the total responses lean in this direction.

The second most frequent category in terms of usage was Convergent Thinking. Much of the Convergent Thinking centered around explanations and conclusion drawing along one given line of thought and forms a recognizable part of most classroom discussions. It appears that class sessions can operate on these two thought operations alone, without much evaluative or divergent thinking. Indeed, in Jack 3 session the entire class hour was devoted to teacher questions only in these two categories. The evaluative and divergent categories appeared to be particularly dependent upon teacher stimulation. The percentage of responses in these two areas were low unless stimulated by deliberate teacher action.

A visual comparison of Figures 1 and 2 will indicate the close relationship between the patterns of teacher questions and the student responses. It is not difficult to understand why. A question such as, "When did Columbus discover America?" is hardly calculated to bring forth divergent or evaluative thinking by the student, although it is not impossible—"Columbus didn't discover America, Leif Erickson did." A question such as "Compare the performances of Olivier and Burton in Hamlet" can hardly fail to evoke student evaluative responses. In short, the teacher controls the expressive thought patterns of the class to a large extent. It will be noted that the English sections, Jack and King, were almost devoid of divergent thinking while being heavily loaded with convergent thinking. This was the result of this particular teacher's style rather than a direct result of the subject matter. Censure shouldn't be automatically applied for the absence of certain thought categories either. No standard exists to suggest that one teacher pattern is "better" than another. The definition of "better" in this case leads to very complex arguments related to the desirable outcome of teaching.

If divergent thinking *is* considered desirable, it can be inserted in any subject matter by changing the type of question asked. For example, the teacher in asking the students to outline a short passage or speech had one best way in mind. The students worked their way towards that best way through successive approximations (convergent thinking). If divergent thinking had been a goal of the teacher he could have posed the problem—How many ways could you reorganize this passage, keeping the same content, so as to meaningfully change the outline?

Other analyses suggest, as is obvious in the Hat series, that a teacher will modify his pattern from one class session to another in the same series and that one teacher's style is distinctively different from another teacher's. It is not possible to observe and catalogue one day's performance and expect to have a typical sample of one teacher's style. There also is the suggestion that the same teacher may show a different style of teaching depending upon the group he is working with (observe in Figure 1 the differences between Hat and Idea groups with the same teacher teaching the same content on the same day to two different sections).

In each of the classroom groups studied, boys were significantly more expressive in some of the thought dimensions used in this study than the girls, although the dimension and intensity of difference varied with the class group and subject matter. In no instance was there a significant difference in favor of the girls. The general conclusion then was that boys tended to be more expressive in the classroom situation. The male sex role of expected aggressiveness being learned at this age level was one of the possible explanations offered to account for this result. No sex differences were found on written expressiveness!

Although originally it had been expected that different students would show different expressive patterns (*i.e.*, one specializing in divergent thinking, another concentrating on evaluation), this was not found to be the case. Instead, the high intercorrelations of all of the categories in classroom expressiveness, mostly in the .80's, made it clear that there was one general factor of expressiveness that was operating and that if a student was expressive in divergent thinking the chances were very high that he scored high on the other categories also. There remained the interesting question as to what other variables might relate to this expressiveness factor.

An adjusted score for classroom expressiveness was obtained for each student by dividing his production for the five days by the total production for the whole class for those class sessions. For example, if Sam gave 10 divergent responses while his class gave 100 responses in this category, his adjusted score would be 010 for divergent thinking responses. If Mary gave 20 such responses while her class was giving a total of 200 responses in this category,

Table I

The Comparison of Expressive and Nonexpressive Gifted Students on Cognitive Factors and Teacher Ratings

		Expressive			*Nonexpressive*		
		N	*Mean*	σ	*N*	*Mean*	σ
Verbal IQ	B	27	133.00†	9.56	27	128.44	7.93
	G	27	128.22	10.46	29	127.24	9.36
Non-verbal IQ	B	27	129.33	7.62	27	129.89	8.45
	G	27	128.81	11.14	29	127.69	11.21
Uses Breadth	B	26	21.58	6.46	27	19.67	5.53
	G	27	19.96	8.03	29	17.48	5.67
Consequences Breadth	B	26	15.00	3.90	27	14.11	3.47
	G	27	13.78	2.65	29	13.48	2.89
Consequences Solutions	B	26	39.88	18.81	27	31.78	19.22
	G	27	41.04	20.05	29	47.52	17.82
Teacher Rating Cognition	B	26	8.65**	3.99	27	11.74	4.11
	G	27	10.56 *	3.77	29	12.86	4.57
Teacher Rating Sociability	B	26	2.31	.79	27	2.41	.93
	G	27	2.00	.62	29	2.00	.76

†Significant at .10 level of confidence *Significant at .05 level of confidence **Significant at .01 level of confidence

her adjusted score would be 010, or the same as Sam's. In this way, it was possible to compare performance across class groups.

In order to compare the expressive *vs.* nonexpressive groups, the top third of the total sample recorded was chosen on the basis of their adjusted class scores and compared with the bottom third of the group on adjusted class scores on expressiveness. A part of this comparison can be found in Table I. The information for boys and girls was considered separately since interesting sex differences in patterns of performance were noted throughout the current study.

It might be expected that students scoring higher on verbal IQ would be the most expressive students in the classroom but this expectation held, in the present study, only for the boys. Table I shows that the mean I.Q. of the expressive boys was 133 as opposed to 128 for the nonexpressive boys and this difference exceeded only a probability level of <.10, but the differences between expressive and nonexpressive girls was almost nonexistent. No differences were found between the two groups, on nonverbal intelligence scores.

The Uses and Consequences tests were developed by Guilford and have been used as one of the key measures of divergent thinking in a number of other studies (4, 13). The students are asked questions such as, "How many different uses can you think of for a brick?" or "What would happen if everybody were born with three fingers and no thumb?" The answers are then considered in terms of the number of different categories the student can produce in his answers and in the style of answer given. In Table I it can be seen that none of the differences between these two groups for either sex reached a level of statistical significance. Thus, a test measure which was specifically designed for measuring written expressiveness does not seem to predict oral expressiveness in the classroom. On the Consequence Solutions score (on items like the "Three fingers" the student will answer, "Cars would have new types of steering wheels" instead of "You couldn't drive cars"), no statistically significant differences were obtained, but it can be noticed that the trends are in opposite directions for the two sexes. The most expressive boys give more solutions but the more expressive girls give less solutions to the Consequences questions.

The teachers were given the task of rating the students along two dimensions, cognitive abilities and sociability. In Table I, the teachers significantly distinguished in their ratings between the expressive and nonexpressive students of both sexes. Since a low score means favorable rating, this meant that the teachers significantly rated higher on cognitive abilities those students who were the most expressive. It can be argued that it is this very expressiveness in class that might be influencing and directing the teachers' judgments in this regard.

This favorable rating on cognitive area did not carry over into the social dimension. No statistically significant differences were found on ratings of social success between the two groups. In summary, in this general area, the expressive boys differed from the nonexpressive boys on a measure of verbal IQ and on teacher ratings of cognitive abilities. The only difference between the expressive and nonexpressive girls was found on teacher ratings of cognitive abilities. These differences were not as great as might be expected and led to the further supposition that other than strictly cognitive abilities were determining the amount of thought expressiveness in the classroom.

Each of the students in the present study was administered a semantic differential

Table II

The Comparison of Expressive and Nonexpressive Gifted Students on Semantic Differential Scale

			Expressive			*Nonexpressive*	
Concept		*N*	*Mean*	σ	*N*	*Mean*	σ
Mother	B	25	68.84	6.18	26	74.26**	5.41
	G	25	72.32	5.93	28	72.17	5.18
Father	B	25	66.36	9.40	26	70.50	7.93
	G	25	70.16	8.49	28	70.25	7.30
Student	B	25	63.88	9.71	26	65.34	7.51
	G	24	67.12	7.75	28	67.89	7.26
Work	B	25	63.60	6.54	26	67.73†	8.20
	G	25	66.56	7.87	28	64.92	8.66
Competition	B	25	66.28	9.32	26	67.61	13.77
	G	25	69.04*	6.57	28	64.53	8.85
Success	B	25	59.72	11.76	26	70.84**	8.07
	G	24	66.83	9.20	28	67.50	8.58
Love	B	25	66.76	9.81	26	70.65	9.02
	G	25	69.80	7.07	28	68.42	7.18
Faith	B	25	67.72	9.14	26	72.11	9.06
	G	25	76.66	8.29	28	73.17	7.60
Imagination	B	25	66.60	7.31	26	62.15	14.72
	G	25	68.96	9.63	28	65.85	7.39
School	B	25	65.72	10.40	26	71.69*	7.20
	G	25	70.24	7.10	28	68.46	7.52

†Significant at .10 level of confidence *Significant at .05 level of confidence **Significant at .01 level of confidence

scale which previously had proven successful in distinguishing between gifted achievers and nonachievers (10). The semantic differential scale was developed from work by Osgood (9). Students are presented with a series of concepts and asked to respond to the concepts in terms of a number of adjective pairs, such as cold-hot, good-bad, active-passive, *etc.* The concepts in the present study are listed in Table II. Fourteen adjective pairs were used and the concept score for a student was the sum of his ratings on the fourteen pairs for that concept.

Table II reveals that differences were found between expressive and nonexpressive gifted boys on a number of the concepts. All of the differences were consistent in the same direction. On the concepts of Mother, Success, School, and Work the nonexpressive group were consistently higher than the expressive group in their ratings. The expressive group could not be said to be rating these concepts negatively, since a neutral score would be 49. It would be more accurate to say they are merely *less* positive in their ratings. One possible interpretation of these differences would be to suggest that the expressive boys possess more self-confidence and more assurance in themselves and do not have to give extreme positive ratings on these concepts.

Students who are less sure of themselves and less inclined to independent judgment, and thus less inclined to contribute to class discussions, might tend to overdo their positive ratings on such socially acceptable concepts (for gifted students) as those on which differences were obtained.

Consistent with other results in this study, the pattern noted for gifted boys is not repeated for gifted girls. Only one difference was found and that indicated a higher level of positive feeling for the concept of Competition for the expressive girls. On most of the other concepts the expressive girls were, on the average, more positive on these concepts than the nonexpressive girls. One suggested explanation would be that girls who are expressive accept the concept of Competition as a desirable factor and are willing to compete on equal terms for classroom recognition with the boys. If these results are confirmed by other studies it is clear that there are different patterns of motives and abilities lying behind the classroom expressiveness of boys and girls.

Summary

The expressive behavior of gifted children at the junior and senior high school level in ten different classrooms was studied through analyzing the tape recordings of five consecutive class sessions. A special classification system was developed as part of the project to allow the categorization of each teacher and student statement. It was found that certain types of thought operations were more common than others in all of the classrooms regardless of subject matter orientation.

Expressive behavior in the classroom in both kind and amount of thought output seemed dependent on the teacher's style of question asking, the sex of the student, the goals of the teacher in a given lesson, the composition of the class group, and the pattern of attitudinal and personality characteristics of the student. Consistent sex differences suggested that different patterns of attitudes and cognitive skills underlie expressive behavior in gifted boys and girls.

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